SIEMENS

Siemens Mobility and Logistics, Traffic Solutions
Sopers Lane, Poole, Dorset. BH17 7ER

SLD4 Loop Detector
General Handbook
Part no.
667/HB/45200/000

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Preface

Safety of Installation and Maintenance Personnel

In the interests of health and safety, when installing, using or servicing this equipment the following instructions must be noted and adhered to:

(1) Only skilled or instructed personnel, with relevant technical knowledge and experience, who are also familiar with the safety procedures required when dealing with modern electrical/electronic equipment, are to be allowed to use and/or work on this equipment. All work shall be performed in accordance with the Electricity at Work Regulations 1989.

(2) Such personnel must take heed of all relevant notes, cautions and warnings in this Handbook and any other Document or Handbook associated with the equipment including, but not restricted to, the following:

(3) The equipment must be correctly connected to the specified incoming power supply.

(4) Only trained / competent persons should work on this equipment.

(5) Any power tools must be regularly inspected and tested.

(6) Any personnel working on site must wear the appropriate protective clothing, e.g. reflective vests, etc.

Safety of Road Users

It is important that all personnel are aware of the dangers to road users that could arise during repair and maintenance of traffic control equipment.

Ensure that the junction area is coned and signed as necessary to warn motorists and pedestrians of any dangers and to help protect the personnel working on the site.

MAINTENANCE PROVISION (MP)

Product Reference

SLD4 Loop Detector – the following orderable variants are:

667/1/45200/001 – Isolated SSR O/P TR2512A

667/1/45200/002 – Non Isolated Open Collector output

667/1/45200/003 – Serial output integrated

667/1/45200/504 – Non-Isolated - Parallel and serial connection to equipment in the same cabinet, with German front panel

667/1/45200/505 – As /004 without front panel

667/1/45200/506 – Non-Isolated - Parallel and serial connection to equipment in the same cabinet, with full 8+1 classification and enhanced firmware features, with German front panel

667/1/45200/507 – As /006 without front panel

667/1/45200/011 – Isolated SSR O/P TR2512A with enhanced firmware features

Note: Not all variants are available or useable in all markets. Consult Siemens Poole Product Management for details.

Features Provided

To aid selection the following table shows the features available for each variant:

	Hardware Feature vs Variant	001	002	003	504	505	506	507	011
	Available (In full production)	✓			✓	✓	✓	✓	✓
Hardware Feature	DC power	✓	✓	✓	✓	✓	✓	✓	✓
	AC power	✓	✓						✓
	4x Isolated SSR detect outputs (Changeover)	✓							✓
	4x Non Isolated O.C. detect outputs		✓		✓	✓	✓	✓	
	4x Non Isolated O.C. Aux (fault) outputs		✓		✓	✓	✓	✓	
	1x Non Isolated O.C. common fault output		✓		✓	✓	✓	✓	
	RS485 High Speed Serial				✓	✓	✓	✓	
	RS422 High Speed Serial			✓	✓	✓	✓	✓	
	TTL High Speed Serial				✓	✓	✓	✓	
	USB Handset (FTDI cable & 3.5mm socket)	✓	✓	✓	✓	✓	✓	✓	✓
	Front panel	✓	✓	✓	✓*		✓*		✓
	Backplane pin out	UK1	UK2	UK3	DE	DE	DE	DE	UK1
Firmware Feature	Single loop processing	✓	✓	✓	✓	✓	✓	✓	✓
	Double Loop processing (speed, length)						✓	✓	✓
	8+1 Class Classification (speed, length)						✓	✓	✓
	Event Log (Faults etc)	✓	✓	✓	✓	✓	✓	✓	✓
	Configuration & Monitoring via PC software	✓	✓	✓	✓	✓	✓	✓	✓
	GSPI / SITOS (High Speed Serial Interface)			✓	✓	✓	✓	✓	
	Programmable Digital Output Configurations						✓	✓	✓

* German front panels

Table 1 – Features Provided

Installation and Commissioning

Methods of Installation are described in this handbook. In addition, there is also a series of documents written specifically for installation engineers who do not need all the information contained in this document. These documents are listed here:

Document No	Description
667/HE/20663/000	Loop Detector and Cable Terminations - Installation and Commissioning
667/HE/31699/000	Loop Inductance and Turns Calculation Spreadsheet
BS7671	Requirements for Electrical Installations

Table 2 – Installation Documents

Application Notes

The SLD4 can be configured in many ways to provide application specific functionality. Where configurations have been designed and tested for specific needs they have been documented in separate Application Notes which can be found under document numbers 667/LN/45230/xxx.

Spares and Maintenance

The SLD4 Detector unit is designed for 'return to base' repair - there are no user serviceable parts on the card. In the case of a faulty card, replace the card ensuring product settings (DIP switches and firmware configuration [if applicable]) are identical to those on the original card.

Modifications

There are no approved modifications for this product.

Warning

Use of components other than those permitted above or modifications or enhancements that have not been authorised by Siemens will invalidate Type Approval of this product.

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FIGURES

1 INTRODUCTION

1.1 Purpose

This handbook gives a general description and specification for the SLD4 detector. It outlines the general procedures for installation, commissioning and maintenance.

Detailed installation instructions can be found in this document and in addition, the appropriate installation guides.

1.2 Related Documents

667/HE/20663/000	Loop detector and cable terminations installation and commissioning handbook
667/HE/20664/000	Installation and Testing (General)
667/HE/31699/000	Loop Inductance Calculator
667/LN/45230/xxx	Application Notes referring to specific operating modes

1.3 Definitions

DIP	Dual In-Line Package
O.C.	Open Collector
EEPROM	Electrically Erasable and Programmable Memory
HA	Highways Agency
LED	Light Emitting Diode
PCB	Printed Circuit Board
N/A	Not Applicable
NC	No Connection
SCOOT	Split Cycle Offset Optimisation Technique
MOVA	Microprocessor Optimised Vehicle Actuation
UART	Universal Asynchronous Receiver Transmitter
CPU	Central Processing Unit
GSPI	Generic Serial Peripheral Interface Protocol
SiTOS	Siemens Traffic Communications Protocol

1.4 Issue History

1	Release
2	Updated for FP2
3	DE OC Detect O/P changes
4	FP2 Update
5	Update for new German versions

2 GENERAL DETECTOR INFORMATION

2.1 The SLD4 Detector

The Siemens SLD4 is a loop detector for 4 loops (L1 to L4). Most important operator control functions are accessible by switches. More detailed features and additional functions can be set using the PC configuration program. The detector features:

- Four detection channels with various output options
- Fully automated set-up optimized for VA operation
- Self-tuning operation
- High detection accuracy
- Low power operation
- Standard 3U card format
- Designed to meet UK specification TR2512A (Variants /001 and /011 only)

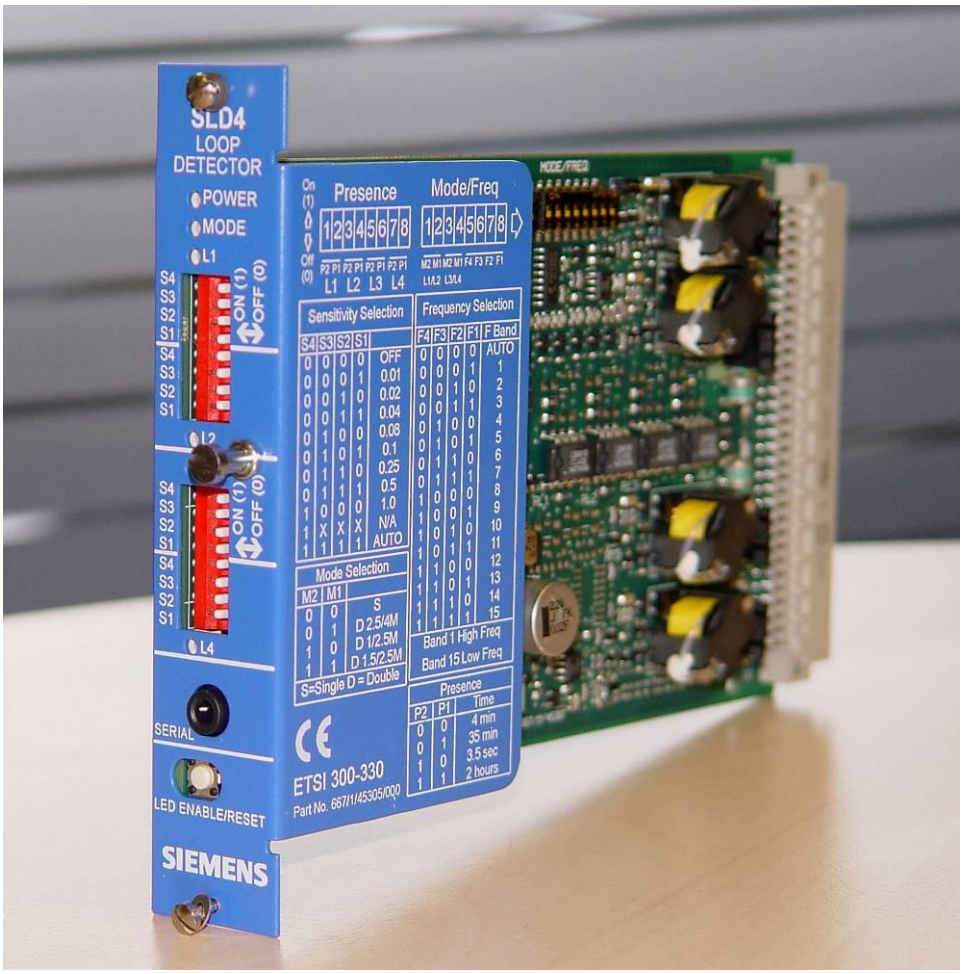


Figure 1 – SLD4 Detector – (001 variant)

The SLD4 uses the latest inductive loop detection algorithms to provide exceptional detection performance in a wide range of applications. Fully compliant with TR2512 the detectors interface with all popular traffic control equipment and the automated set-up features ensures optimal performance is always achieved.

2.1.1 Operational details

The SLD4 loop detector is a self-tuning unit in a 3U format with various pin-out options including the standard defined in TR2512. Providing four separate detection channels, the SLD4 offers fully solid state output variants designed for maximum reliability. SSR relay variants offer both normally open (n/o) and normally closed (n/c) configurations.

The detector may be powered from either AC or DC supplies and offers both low power and full operation down to 10V DC, which makes support within battery powered equipment a viable option where needed.

A range of LED's on the front panel provide indication of loop detection and faults. The LED's are disabled after a preset time to reduce power consumption. These can be activated when an Engineer is present by means of a push button on the front panel, which also provides a reset facility.

2.1.2 Automated set up

In large installations manual setting of frequency and sensitivity parameters can often be a challenge and failure to achieve this correctly can cause detectors to 'chatter' or otherwise fail to operate correctly.

The SLD4 offers a unique feature where, when fitted in a rack with other SLD4 detectors, all units are able to communicate with each other so as to automatically set critical parameters. Once all the detectors are fully set-up, LED's on the front panel of each detector flash in synchronism to signal that auto-setup has been achieved and the selected parameters are stored in non-volatile EEPROM memory to allow the detector to quickly return to the same operating mode after a power cycle.

Automatic setup has been optimized for VA applications.

Manual set-up is also possible, with sensitivity level, presence time and frequency, loop mode and size selection being offered via DIP switches.

For special applications a PC tool is also available. This tool allows access to a wide range of detection parameters allowing detectors to be individually set up for specialist applications. A dedicated USB cable is required to access the detector using the front panel serial connector.

- This is not an RS232 interface and only the approved USB cable can be used – The Siemens Heimdall cable is **not** suitable for use with the SLD4 Loop Detector.
- When using 24 AC supply to the detector, only use battery powered interface equipment (e.g. laptop, PDA). Do not connect mains powered/connected interface equipment to the SLD4. Failure to observe these precautions may damage the detector and/or the connected device.

2.2 Internal processing overview

The following section is designed to give an overview of the processing within the detector to enable greater understanding of internal operation and the advanced configuration modes. The default mode of operation is single loop mode.

The SLD4 is a 4 channel loop detector and therefore provides 2 loop pair processing streams as shown in Figure 2. These two processing streams can be configured to operate in single loop mode if just vehicle presence information is required. Figure 3 shows the data flow within the detector for each loop pair stream. The following sections describe each module and some of the configuration options which provide some of the advanced modes.

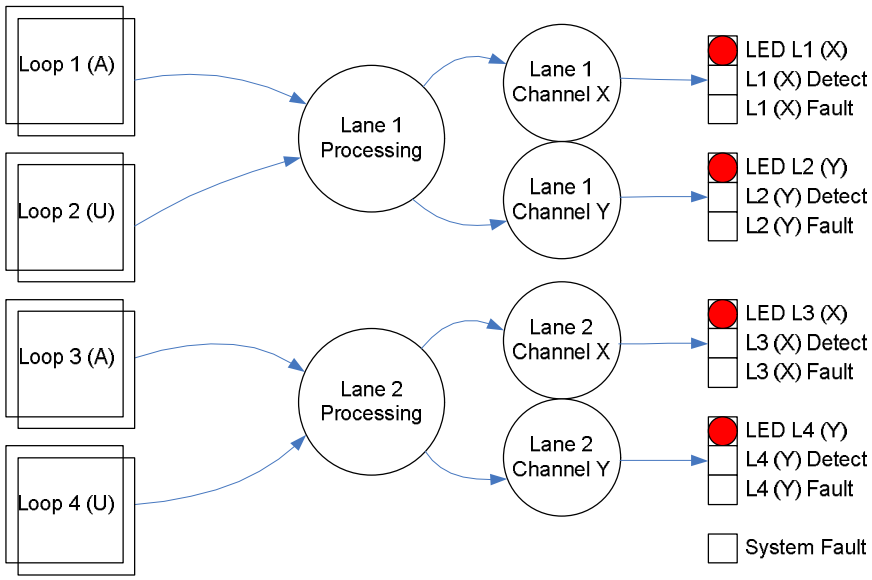


Figure 2 – SLD4 Lane and channel processing in the default mode

Note: This section uses loop definitions A and U. These definitions come from the U/D environment. The X and Y Lane identifications are used as the outputs are configurable which gives maximum flexibility.

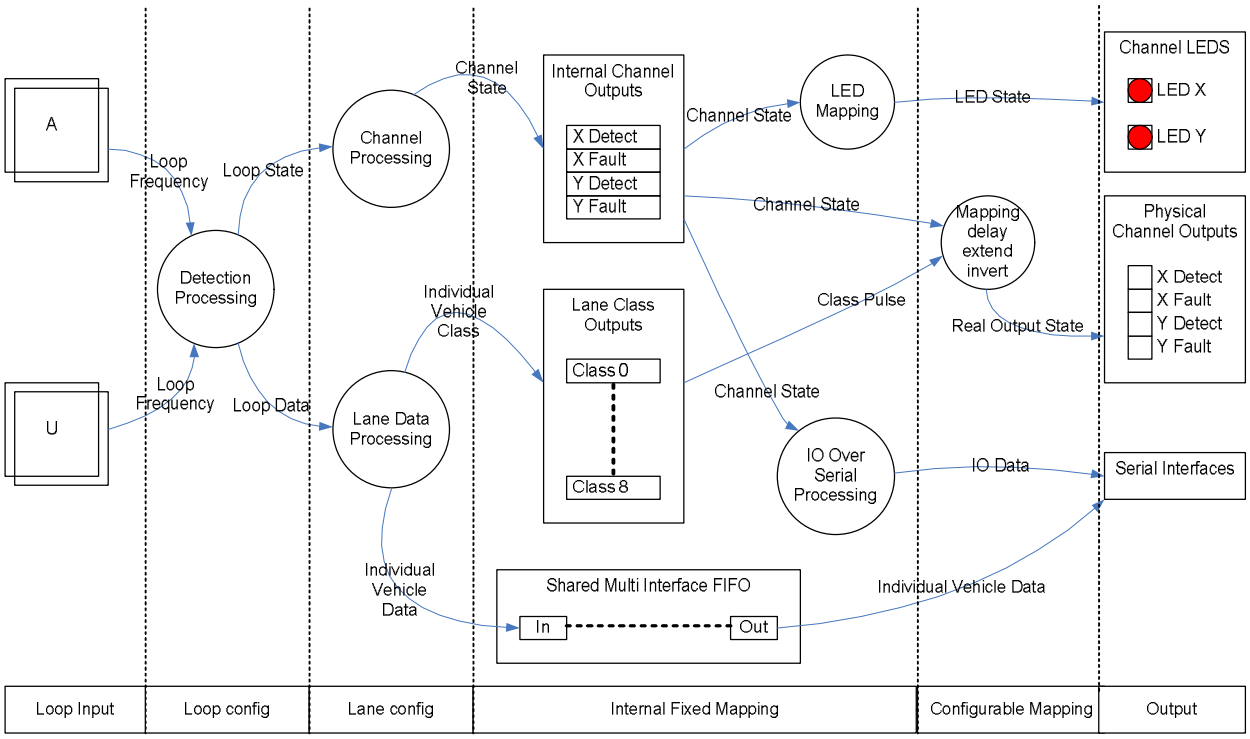


Figure 3 – SLD4 Internal processing for each loop pair

2.2.1 Loop Input

For each loop pair there is an (*A*) loop and a (*U*) loop. In double loop mode the *A* loop should be the upstream loop and the *U* loop the downstream loop so that a vehicle travelling in the *Normal* direction would traverse *A* then *U* and in the reverse direction travel *U* then *A*. In single loop mode the position of *A* and *U* relative to each other is irrelevant.

2.2.2 Detection processing

The detection processing module analyses the data from each loop and determines individual loop detect and fault states. There are a number of configuration items that can influence the individual loop detection processing including:

- Detection sensitivity threshold – various auto and fixed modes
- Presence time – time after which a detected vehicle is “tuned out”
- Operating frequency – various auto and fixed modes
- Sampling duration and frequency
- Transient threshold
- Fault suppression time

More information about these settings can be found in this document or the configuration tool help text.

2.2.3 Channel processing

The channel processing module interprets the individual and combined loop states to set virtual (internal software) channel IO bit detect and fault states. Each channel can be configured to operate individually (single loop mode) or during a number of predetermined detection sequences from the loop pair to indicate vehicles travelling in a particular direction only (unidirectional). For channel unidirectional detection the loops must be positioned so that when vehicles traverse the loops there must be a time where both loops are in the detect state simultaneously.

Table 6 details the *Output Channel Modes* which can be configured and Figure 4 shows examples of each mode.

Mode	X/Y Detect Output	X/Y Detect output under single loop failure	X/Y Fault output
Single A	Single loop mode using loop A	Fault (Permanent Detect)	Active when fault on loop A
Single U	Single loop mode using loop U	Fault (Permanent Detect)	Active when fault on loop U
Normal A	Normal direction only, output active with loop A	Single mode with remaining loop	Active when fault on loop A or U
Normal U	Normal direction only, output active with loop U	Single mode with remaining loop	Active when fault on loop A or U
Reverse A	Reverse direction only, output active with loop A	Single mode with remaining loop	Active when fault on loop A or U
Reverse U	Reverse direction only, output active with loop U	Single mode with remaining loop	Active when fault on loop A or U
Normal A Fault A	Normal direction only, output active with loop A	Fault A: Fault (Permanent Detect) Fault U: Single mode with loop A	Active when fault on loop A or U
Reverse U Fault U	Reverse direction only, output active with loop U	Fault A: Single mode with loop U Fault U: Fault (Permanent Detect)	Active when fault on loop A or U

Table 3 – Channel output modes – single and unidirectional

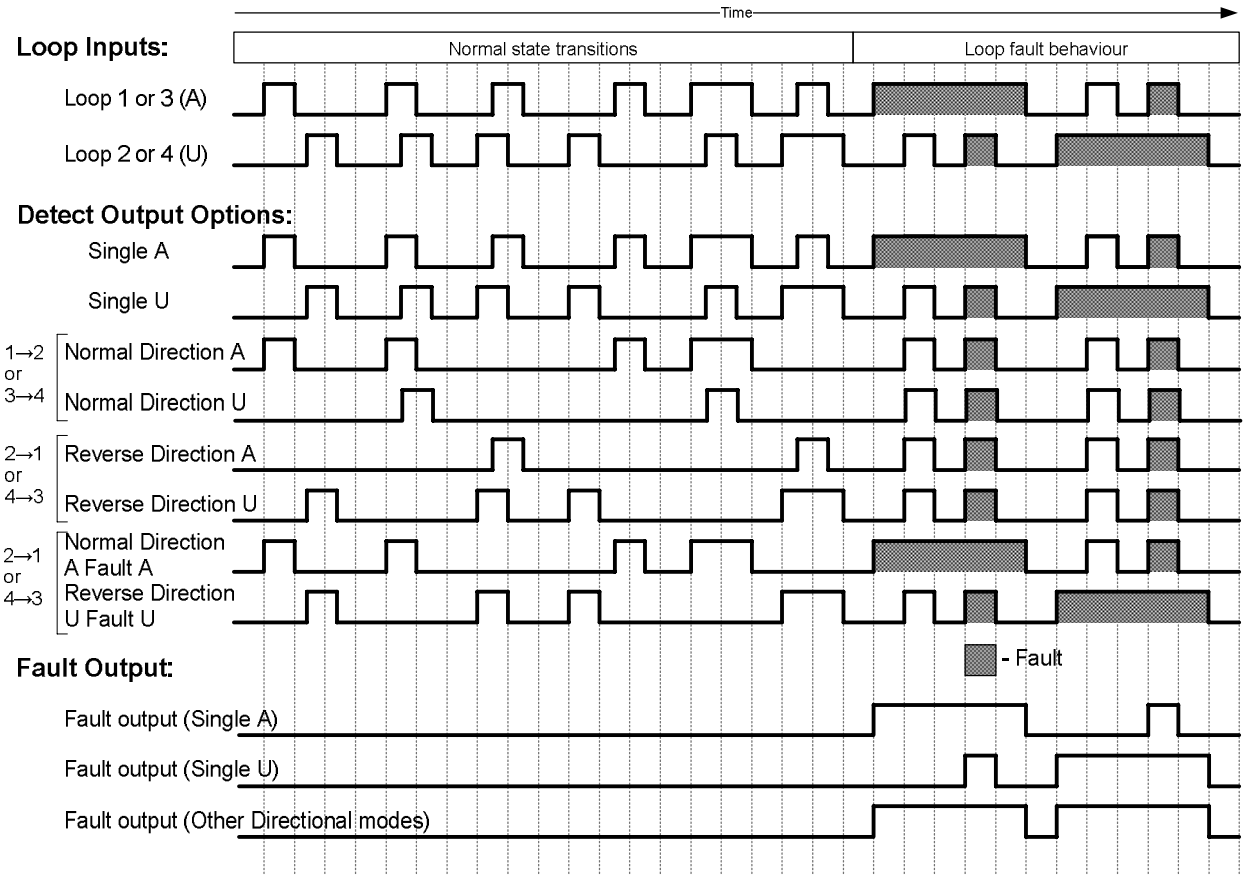


Figure 4 – Channel output mode examples

2.2.4 Lane data processing

The lane processing module analyses the detection state and timing data from single or double loops and converts this into individual vehicle data records. In single loop mode, the following data is calculated:

- Times – entry, preceding gap, occupancy (time durations in ms)

In double loop mode the detection sequences from two loops are combined to also calculate:

- Direction
- Speed
- Length
- Classification
- Times – second occupancy and travel time between loops

In addition for each individual vehicle record a raw loop frequency profile is captured. The viewing of this profile can assist in setup and diagnostics of the detector.

The detector provides 8 configurable classification bins, which can be configured by length and speed ranges and also vehicle direction. The same classification definitions apply to both lane processing streams within the detector.

The lane processing module accepts the following configuration options:

- Lane mode
  - Single
  - Double any direction
  - Double normal direction only
  - Double reverse direction only
- Lane headway – distance between the leading edges of the loops when in double loop mode
- Loop length – The length of the loops
- Length Adjustment – Optional adjustment of the vehicle length reported for this lane

Individual vehicle classifications are mapped to virtual (internal software) IO bit states, which can then be mapped to the physical outputs of the detector. The individual vehicle data records are also entered into a shared multi interface queue. This 25 vehicle queue is shared across both lanes within the detector and all serial interfaces. It is implemented so that detected vehicles can be collected simultaneously from any of the multiple serial interfaces on the detector. When the queue overflows, the oldest vehicle is discarded and a vehicle overflow count incremented. The overflow count can be retrieved from the detector if required.

2.2.5 Output mapping

The LEDs operate a fixed mapping from the respective internal output channel as shown in Table 4. This therefore means that the LEDs can indicate single or unidirectional detection depending on the detector configuration.

Detect	Fault	LED State
0	0	Off
1	0	On
X (Don't care)	1	Fast Flashing

Table 4 – LED output mapping table

There are up to 9 (depending on detector variant) physical outputs on the detector. The function of these outputs can be configured to activate on a logical combination of current internal bit states. In addition each physical output can be: converted to a pulse, delayed, extended and inverted. Pulse, delay and extension are shown in Figure 5.

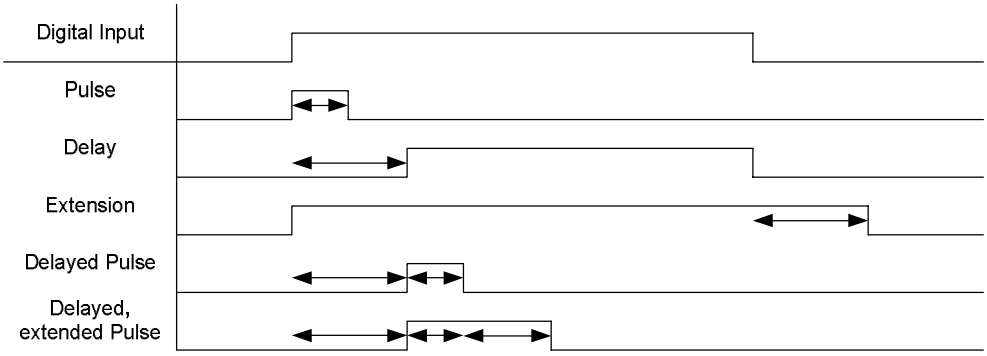
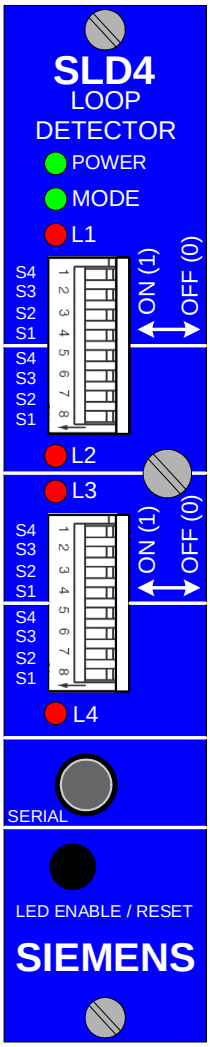


Figure 5 – Output Pulse, Delay & Extension

Note: when using the delay function, the output will not activate if the input is re-triggered before the set delay expires. This will effectively filter out vehicle activations that occur below the set delay period.

2.3 Interface

The SLD4 detector has three main interfaces.



2.3.1 LED's and push button

LED indicators mounted on the front panel of the detector which gives a visual indication of the detector status.

One LED per channel to indicate presence and fault status.

Power and mode LED's to indicate mode and other fault status.

Front panel push button for LED enable/disable and reset functions

LEDs are enabled for 20 minutes

2.3.2 Configuration DIP Switches and Links

Detectors are fitted with:

2 x 8 way DIP switches accessed on the front panel, 4 DIP switches per loop for manual sensitivity setting

2 x 8 way DIP switches accessed on the PCB for presence, mode and manual frequency setting

2 hand bag links per channel for loop connection range

shows the switch and link positions for user selectable parameters.

2.3.3 Serial Interfaces

A number of serial interfaces are available depending on the variant. See Product Reference table at the start of this handbook for options.

2.3.3.1 Front Panel PC interface

A serial interface for PC on the front panel of the module using a 3 pole 3.5mm jack socket.

This is used with a 3.5mm / USB adaptor cable Part No. 702/4/08535/000.

All variants carry this interface.

It is imperative that the correct cable and only battery powered interface equipment is used to interface with the detector.

Refer to Appendix D for a description of how to use the handset port and the available handset commands.

2.3.3.2 DIN connector high speed interface

The rear DIN connector carries the High Speed Serial IO (RS422, RS485, Logic Level) which all use the same UART on the CPU so only one interface can be used at any one time.

- The 4 wire RS422 interface is configured for multi-drop operation use where the transmitter can be disabled.
- The 2 wire RS485 interface is configured for multi-drop operation.
- A 3.3V logic level interface providing the following signals:
  - Serial Data Input
  - Serial Data Output
  - Data Direction Control Output

All Interfaces autobaud and can communicate using both GSPI and SiTOS protocols.

3 GENERAL INSTALLATION INSTRUCTIONS

3.1 General Introduction

This section outlines the general information required when installing an SLD4 detector.

3.2 Tools Required

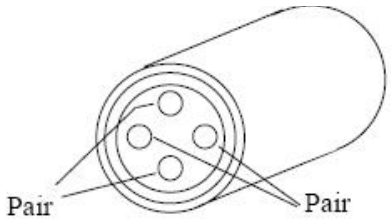
As well as a standard Installers tool kit, the following are required when installing and maintaining the SLD4 Detector:

- Small flat bladed screwdriver – for DIP switch adjustment.

3.3 Loop Installation

It is recommended that installation of the loops be in accordance with 667/HE/20663/000 - Installation Handbook No. 3 (Detectors and Loops).

Note that multi-pair feeder cables must not be shared between 2 or more detector cards. When using 2-pair cable the pairs are the opposite conductors - see diagram.



In the case of 3 or more pairs, the pairs must be twisted, then the pairs must be twisted together to make up the total cable.

Note that the principle is to achieve mechanically and electrically stable loop/feeder installations. The conductors must not be able to move in the slots, there should not be lengths of loop tails laid untwisted in ducts or soft sand.

Loops that are near to each other in the carriageway or occupy the same feeder cable should be connected to the same detector card.

4 COMMISSIONING

4.1 Commissioning Procedures

4.1.1 Basic settings

The basic settings of all DIP switches as delivered from the factory will configure the detector as follows:

- Automatic Sensitivity (optimised for VA operation)
- Automatic Frequency allocation
- Four minute Presence time
- Single Loop operation

The SLD4 offers a unique feature where, when fitted in a rack with other SLD4 detectors, all units are able to communicate with each other so as to automatically set critical parameters. Once all the detectors are fully set-up LED's on the front panel of each detector flash in synchronism to signal that auto-setup has been achieved.

When a detector rack is populated with more than one detector card the left hand card (looking from the front) will be the Master card and will communicate with the other cards via an on-board infra-red link. Where detectors are positioned one above another and use Intelligent Detector Backplanes, an interlinking cable between these backplanes allows the infra-red link to be extended to the set of detectors below creating one group of detectors.

If some detectors are set to operate at specific frequencies (manual setup using DIP switches), the remaining cards setup in automatic mode in the communicating group will be assigned frequencies that do not clash with those set manually.

All DIP switch options are printed on the side panel of the detector as shown in Figure 7.

Appendix C – Switch and Link positions in section 5.5 shows the positions for links and DIP switches.

Where long feeders in excess of 300m are used, refer to section 5.6 for guidance on how to configure the detector.

The detector can also be configured using the PC based configuration tool as described in section 5.2

4.1.2 Sensitivity selection

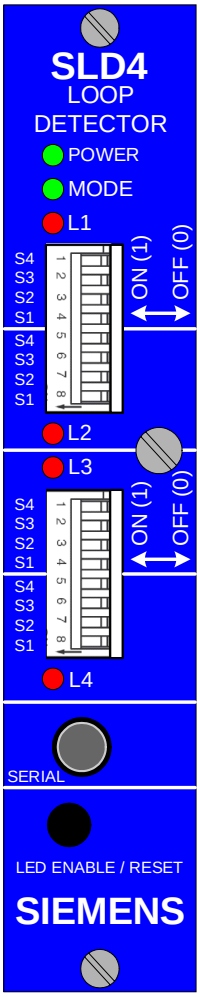
There may be reasons why the auto-tune facility needs to be over-ridden, for example when setting up MOVA or SCOOT loops that should be set to a specific sensitivity.

Sensitivity selection for each channel is done using the DIP switches on the front panel, 4 switches per channel (see Table 5).

Sensitivity Selection				
S4	**S3**	**S2**	**S1**	**%ΔL/L**
0	0	0	0	**OFF**
0	0	0	1	**0.01**
0	0	1	0	**0.02**
0	0	1	1	**0.04**
0	1	0	0	**0.08**
0	1	0	1	**0.1**
0	1	1	0	**0.25**
0	1	1	1	**0.5**
1	0	0	0	**1.0**
1	x	x	x	**N/A ***
1	1	1	1	**AUTO**

Table 5 - Sensitivity Selection

* These switch settings are engineering settings and should not be used.



The following table details the typical sensitivities used for particular applications.

Mode	Sensitivity %ΔL/L
VA	0.02% - 0.04%
SCOOT	Loop dependant See 667/HE/20663/000 Section 2.11
MOVA	0.1%
MOVA Stopline	0.1% - 0.5%
Cycle	0.02% - 0.04%

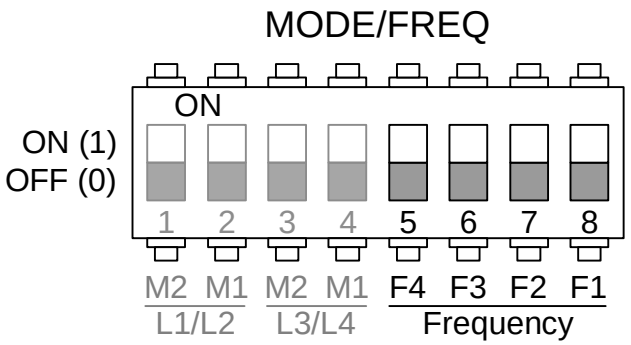
Table 6 – Typical Sensitivity Settings

4.1.3 Frequency Selection

To manually select individual card frequencies the table printed of the side panel should be followed. The frequencies allocated are in 15 bands where band 1 is the highest frequency and band 15 the lowest frequency.

Normally auto frequency allocation should be used but manual frequency allocation may be desirable if the system is suspected to suffer from interaction between cards/loop/environmental conditions.

Frequency Selection				
F4	**F3**	**F2**	**F1**	
0	0	0	0	**AUTO**
0	0	0	1	**1**
0	0	1	0	**2**
0	0	1	1	**3**
0	1	0	0	**4**
0	1	0	1	**5**
0	1	1	0	**6**
0	1	1	1	**7**
1	0	0	0	**8**
1	0	0	1	**9**
1	0	1	0	**10**
1	0	1	1	**11**
1	1	0	0	**12**
1	1	0	1	**13**
1	1	1	0	**14**
1	1	1	1	**15**



See Figure 9 in section 5.5 for switch position

Table 7 - Frequency Selection

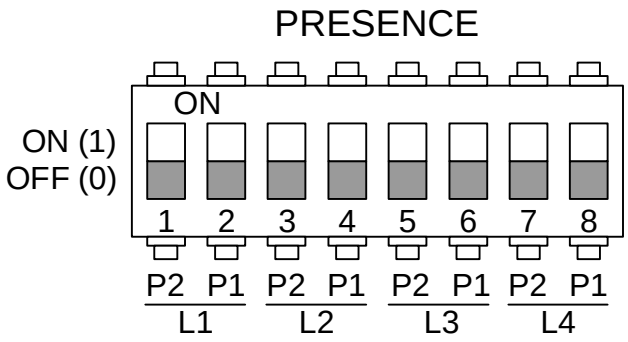
Note: Higher frequencies give better accuracy for vehicle types so the aim should be to select higher frequencies where possible.

4.1.4 Presence time selection

The default setting of 4 minutes should be used standard traffic applications. Certain situations may require different times. Different times can be set using P1 & P2 switches on the Presence switch on the PCB for each channel.

Presence Time		
P2	P1	
0	0	4 min
0	1	35 min
1	0	3.5 sec
1	1	2 hours

Table 8 - Presence Time



See Figure 9 in section 5.5 for switch position

4.1.5 Loop configuration

The default setting is single loop operation – All 4 channels operate independently. The MODE/FREQ DIP switch is used to configure the loop operating mode.

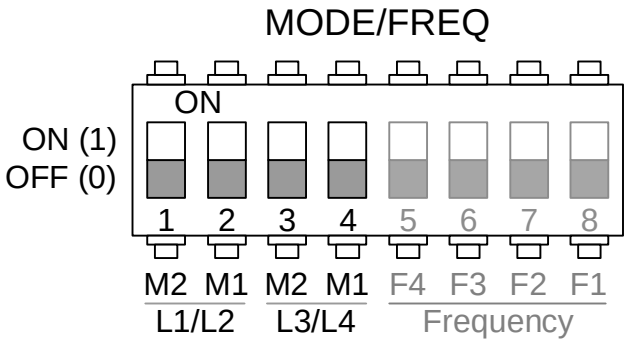
Double loop operation is available from firmware variant 002 on enhanced detectors which will allows 2 loops to operate together (L1 & L2) and (L3 & L4).

Double loop operation allows speed, length and classification to be determined. This information can then be mapped to a digital output as well as available on the High speed interface and in the Configuration tool.

Mode Selection		
M2	M1	
0	0	Single
0	1	Double Loop 2.5 / 4m*
1	0	Double Loop 1 / 2.5m*
1	1	Double Loop 1.5 / 2.5m*

Table 9 – Loop Mode

* Refer to Figure 6 below for reference dimensions related to Table 9



See Figure 9 in section 5.5 for switch position

* 1st dimension – length of loops – X
  2nd dimension – Headway - front edge to front edge distance – Y

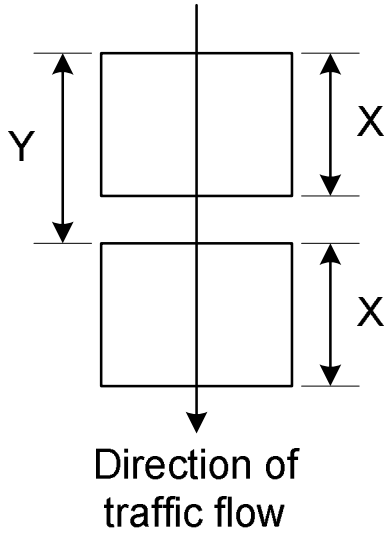


Figure 6 – Loop Dimensions

4.1.6 Loop connection range

Different connection ranges must be chosen depending on the loop inductance and the feeder length so as to ensure that the desired loop frequency can be set. In most cases, range 1 will be suitable (default). If the range is unsuitable, automatic frequency adjustment is not possible and the LED flashes to indicate the setting error.

Range	L1	Jumper PL3	Used for	Loop inductance
	L2	Jumper PL4		
	L3	Jumper PL5		
	L4	Jumper PL6		
1		1-2, 3-4	Low inductance values and/or short feeders	Approx. 20 – 150 µH
2		2-3, 4-5	Medium inductance values and/or medium feeder lengths	Approx. 150 – 300 µH
3		1-2, 4-5	High inductance values and/or high feeder lengths	Approx. 260 – 2000 µH

See Figure 9 in section 5.5 for switch position

Loop feeder length minimum in the range of 0 - 300M extendable up to 1000M. Recommended loop cable 1.5 mm^2 or 2.5 mm^2.

As a guide:
Short feeder <100m
Medium feeder 100-300m
Long feeder >300m

An estimate of the loop inductance can be read by the PC configuration tool. This estimate is only valid if the loop is configured in inductance range 1.

A loop inductance tool 667/HE/31699/000 is available to help determine inductance based on loop size, cable length and number of turns. The table below shows the link ranges for typical loop configurations. This should only be used as a guide as feeder cable will increase apparent inductance.

INDUCTANCE OF STANDARD SIZED LOOPS

Length of Long Side (m)	Length of Short Side (m)	Number of Turns	Inductance (µH)	Link Range
1	1	1	5.8	N/A
1	1	2	19.2	1
1	1	3	41.8	1
1	1	4	72.4	1
1	1	5	110.4	1
2	2	1	12.7	1

2	2	2		42.8	1
2	2	3		93.6	1
2	2	4		162.5	2
2	2	5		248.6	2
3	3	1		20.1	1
3	3	2		68.1	1
3	3	3		149.2	1
3	3	4		259.3	2
3	3	5		397.2	3
4	4	1		27.7	1
4	4	2		94.4	1
4	4	3		207.2	2
4	4	4		360.5	3
4	4	5		552.6	3

It is important that these jumpers are set correctly to match the loop inductance. Failure to do so will degrade system performance.
To minimize the effect of loop interaction the jumper should be set to maximize the available operating frequency range between 30KHz and 120KHz. The available range can be found using the **PC Configuration Tool** and viewing the minimum and maximum operating frequencies.

4.1.7 Connecting the detector board

Carefully insert the board (making sure that the contacts of the plug connector are not bent), check that backplane connector is engaged and tighten the two retaining screws, switch on the voltage (the SLD4 may also be fitted while the power is on – 'Hot plug').

4.1.7.1 Detection speeds

- Vehicles (including motor-cycles): 0 – 250km/h (155m/h)
- Cycles: 0 – 40km/h (25m/h)

4.1.7.2 Observing LED's

Each detector channel has one LED to indicate both detection and fault status.

Status	Operation
Loop Detect	On (Vehicle present)
Loop Fault	Fast flash

The Power and Mode LED's will indicate other fault conditions and status as follows:

	LED	
	Power	**Mode**
Manual mode – Sensitivity and Frequency	Slow flash	Off
Auto mode and set up complete*	Slow flash	Slow flash
Software modified configuration - in sync and auto set up complete*	Slow flash	Double pulse at slow flash rate
Software modified configuration - out of sync and auto set up complete*	Slow flash	Double pulse at slow flash rate offset 50% duty
Other (system) faults	Fast flash	As per states below

* - Auto mode is completed after 20 vehicles have been detected on each loop.

When the detector card is operating normally without faults, the power LED will slow flash. The Mode LED status will depend on how the channel has been configured. When there are a number of boards in the rack it should be very easy to identify a faulty board by the Power LED status.

4.1.7.3 Local LED Enable/Reset

The reset button accessed from the front panel allows various functions to operate either by momentarily pressing (tap) the button or holding it down for a short period.

	Function	**Operation**
1	LED enable	1 tap
2	LED disable	2 taps
3	Reset (software)	3 taps
4	Revert to default configuration#	4 taps
5	Reset (hardware)	hold 3sec
6	LED enable ALL LED's in a rack when done on the master*	tap
7	LED disable ALL LED's in a rack when done on the master*	2 taps
8	Reset (software) ALL in a rack when done on the master*	3 taps
9	Firmware recovery mode	tap after reset

[#] - *All* switches must be in the off position. This is a safety measure to stop the user accidentally erasing a configuration. The user should make a note of the switch settings prior to the default configuration reset and return them to those positions after the reset has taken place.

This feature allows the user to reset to the default configuration without the need for the configuration tool and a PC.

* - The master is the left hand most card in the rack

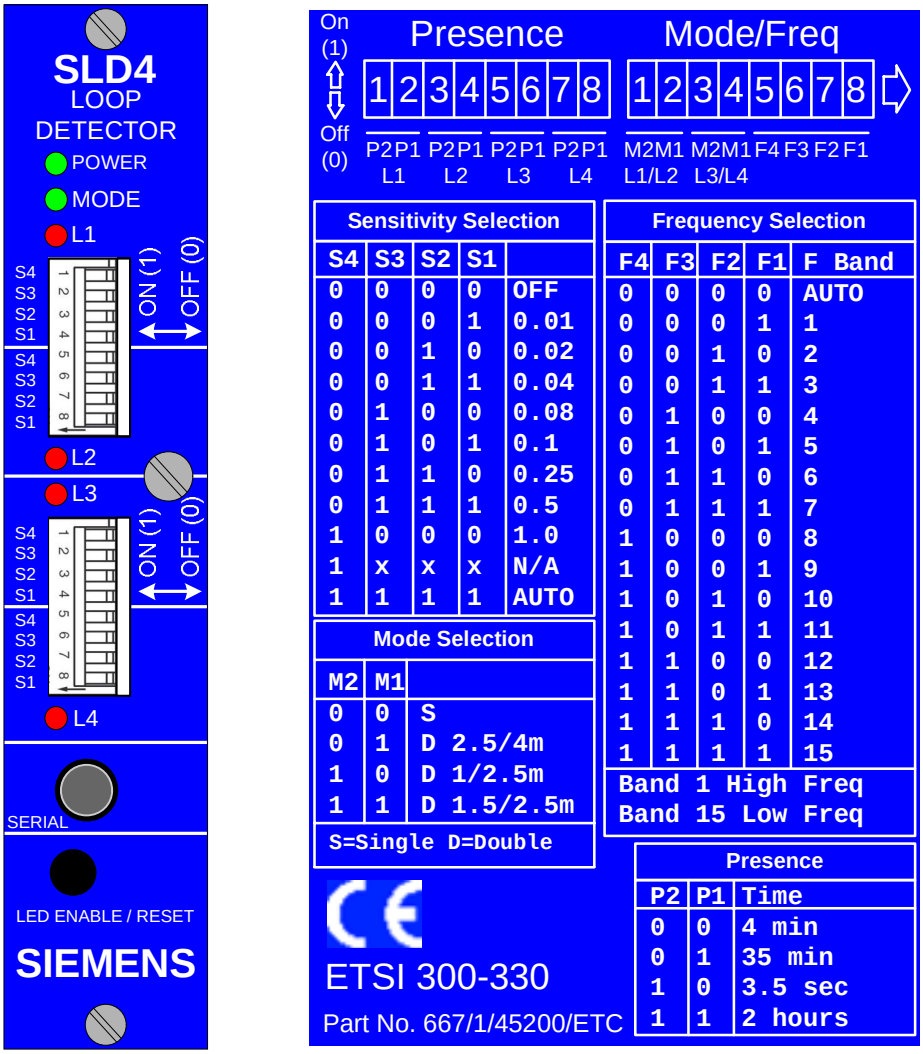


Figure 7 – UK BASIC SLD4 Front & side Panels

5 HANDSET CONNECTIONS

The handset port can be used in two different ways but both **must** use the dedicated USB cable 702/4/08535/000 and the cable driver must always be installed – see section 5.8

Method 1: Connect with Hyperterm (or similar terminal emulator) for a simple command line driven interface – see section 5.1

Method 2: Connect with the dedicated PC tool – see section 5.2

When using 24 AC supply to the detector, only use battery powered interface equipment (e.g. laptop, PDA). Do not connect mains powered/connected interface equipment to the SLD4. Failure to observe these precautions may damage the detector and/or the connected device.

5.1 Connection Method 1 - Basic Terminal Connection

A terminal program such as HyperTerminal for Windows can be used to connect to the virtual serial port of the connected device. The com port number allocated by the PC when the unit is plugged in is needed so that the correct port can be opened in the terminal program. The com port number can be identified in Windows XP in the following way:

1. Start Menu –> Settings –> Control Panel
2. System –> Hardware –> Device Manager
3. Ports (COM & LPT)
4. The port will be identified as 'USB Serial Port (COMx)' where 'x' is the port number allocated.

The connection parameters are:

115200 Baud, 8 bits, 1 stop, no parity, no handshaking

To confirm connection press **ENTER** in the terminal window and the detector will respond: SLD4>

The available commands are listed below in bold with the required format and a description of the function. Commands are case insensitive.

The following commands are available (SLD4 reply in Blue):

HELP

reboot – info – time – revert

flts – led – linfo

Provides a list of help commands available
Entering HELP command will provide basic help on the command entered

REBOOT

reboot:1

This will perform a software reset of the detector. No parameters are altered. This is the software equivalent of pressing the reset button.

INFO

Lists details about the detector in the following format:

SIEMENS SLD4 Loop Detector

HW:	667/1/xxxxx/yyy	Hardware part number & variant
DOM:	yyyy/mm/dd	Date of manufacture <yyyy> – Year <mm> – Month <dd> - Day
SN:	xxxxxxxxxxxxxxxxxxx	Serial Number
FW:	667/TZ/45215 va.b.c.d	Firmware ID & version where: a – Major version b – Minor version c – Feature No. d – Release candidate
V EXT:	12.860V	External raw supply voltage
V INT:	1.209V	The CPU core voltage
T INT:	30.373°C	CPU Temperature
BOARD:	x	The board address
LINK:	x	The total number of SLD4 devices found
BOOTC:	x	The total number of power cycles or reboots
SWITCH:	0x12345	The DIP switch state (all switches)

TIME

LifeTime:xxxx UpTime:yyyy

LifeTime – The total powered time for the detector in seconds
UpTime – The powered time since the last reset in seconds

REVERT

Revert:1

Reverts (deletes) the device configuration

REVERT F

Revert:1

Reverts the device to factory settings

FLTS

Lists any active detector faults. The following faults may be displayed:

Reported Fault	Description / Action
F/W Checksum Failure	The firmware is corrupt – The board should be replaced or firmware reloaded
Configuration Checksum Failure	Configuration may be corrupt – Reconfigure board
No or Corrupt Data File	Configuration may be corrupt – Reset board*
Watchdog Failure	Indicates that the watchdog has tripped. This flag can be reset by resetting the board. May indicate a faulty card if occurring regularly. Card will automatically reset and continue working.*

EEPROM Access Failure	Abnormal software function – Reset board*
Loop x Failure	The numbered loop has failed and cannot be tuned – Check loop information (LINFO) and loop integrity
Loop x Threshold Error	The threshold is close to the loop noise floor – Consider decreasing the sensitivity and/or check loop integrity
Software Initialisation Failure	Abnormal software function – Reset board*
Software Timing Error	Abnormal software function – Reset board*
S/W Schedule Error	Abnormal software function – Reset board*
S/W State Machine Error	Abnormal software function – Reset board*
S/W General Error	Abnormal software function – Reset board*
Digital I/O Scheduling Error	Abnormal software function – Reset board
Hardware Error	General hardware fault - The board should be replaced
Supply Voltage Low	Check power supply voltage
Unrecognised Hardware	General hardware fault - The board should be replaced
Link Error	The inter card link is suffering data loss/corruption. Check optical path and/or cabled link (if applicable)

*- If fault persists – replace the board

LED=0

led:0

LED=0 turns all LEDs off

LED=1

led:1

LED=1 turns all LEDs on (Will turn off automatically after 20 minutes)

LINFO List details about the detector loops, operating frequency, tuning range etc:

Loop	1	2	3	4	
FMax	xx	xx	xx	xx	The maximum frequency the loop can tune to.
FMin	xx	xx	xx	xx	The minimum frequency the loop can tune to.
MaxT	xx	xx	xx	xx	The maximum tuning value that the loop can use.
FKHz	xx	xx	xx	xx	The allocated frequency band.
Tune	xx	xx	xx	xx	The tuning value allocated in automatic mode: 0-511
Bkgnd	xx	xx	xx	xx	The actual loop operating frequency in Hz
Noise	xx	xx	xx	xx	The noise level in Hz[1].
SenHz	xx	xx	xx	xx	The sensitivity threshold level in Hz[2]
PMax	xx	xx	xx	xx	The maximum peak deviation for the last 20 vehicles[3]
PAvg	xx	xx	xx	xx	The average peak deviation for the last 20 vehicles[3]
Dcnt	xx	xx	xx	xx	The Loop detector count totals

Notes:

[1] This is a statistical value aimed to give a guide to loop ‘quality’. Lower values indicate good quality, well placed / wired loops. This value should be at or below the sensitivity threshold.

High ‘Noise’ values might indicate: Interference, Poor quality joints or leaky feeders/loops.

[2] The frequency threshold which a vehicle must pass before it can be detected.

[3] This vehicle count is configurable using the PC software tool.

All references to frequencies are displayed in Hz.

5.2 Connection Method 2 – PC software configuration tool

A PC based configuration tool is available (667/TZ/45216/000) that allows:

- Access to detector configuration and status
- Reading internal fault logs
- Vehicle monitoring and simulation
- Firmware upgrade

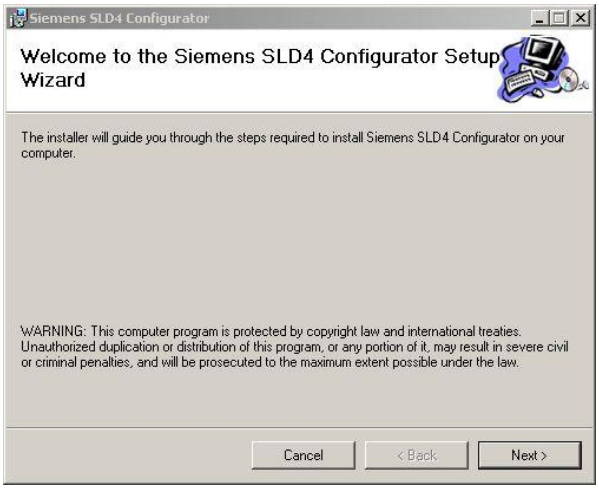
Note: Not all features that are described are available on all detector variants. Refer to Table 1.

The USB drivers and Configuration tool have been tested with Windows XP 32bit and Windows 7 32bit and 64bit operating systems.

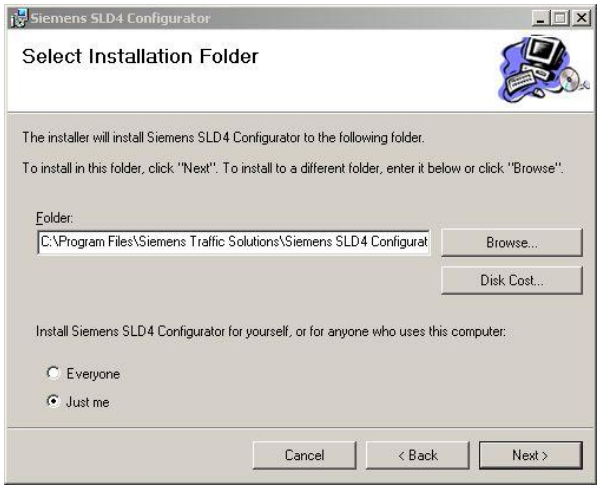
5.2.1 Installation

The tool must be installed onto the target PC. The installation files must be unzipped to a local drive before installation commences.

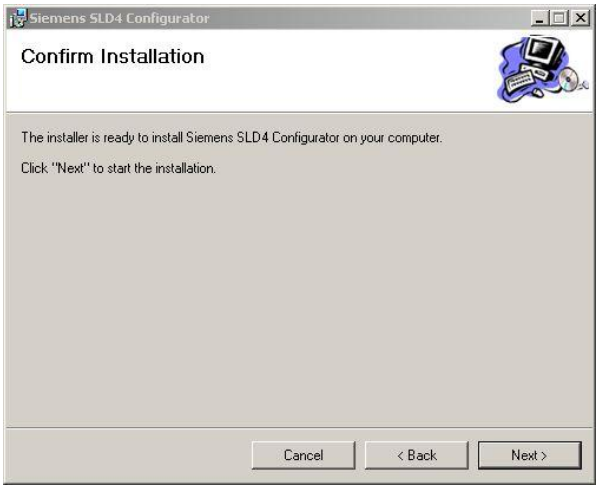
Run [Setup.exe] to start the installation process and follow the on screen instructions. This will install all necessary software:

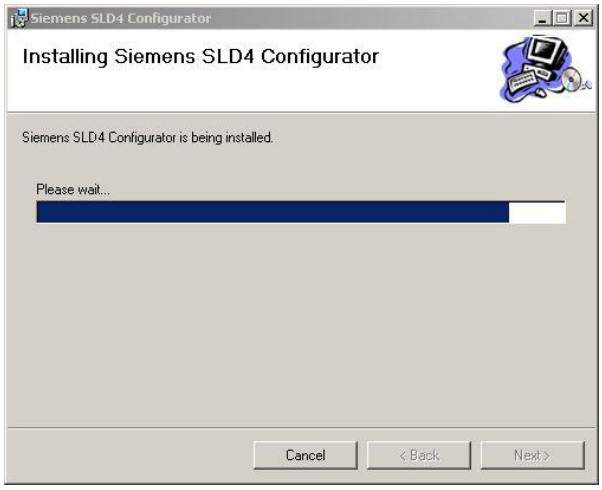


Click 'Next'

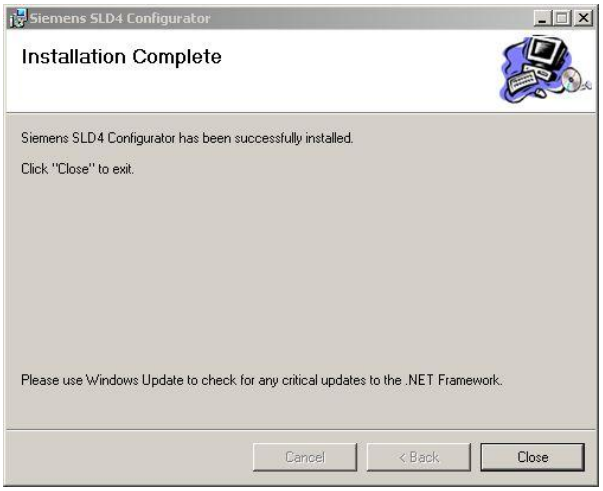


Select a suitable folder for the installation and then click 'next'





Click 'Next' to start the installation



The configuration tool has now been successfully installed.

The tool can now to run from Start Menu ->Programs ->Siemens Traffic Solutions ->SLD4 Configurator

5.2.2 General

For information on an item, help text is displayed for each item in the 'Help' Window at the bottom of the application. To view help for a particular item, click on its data entry field.

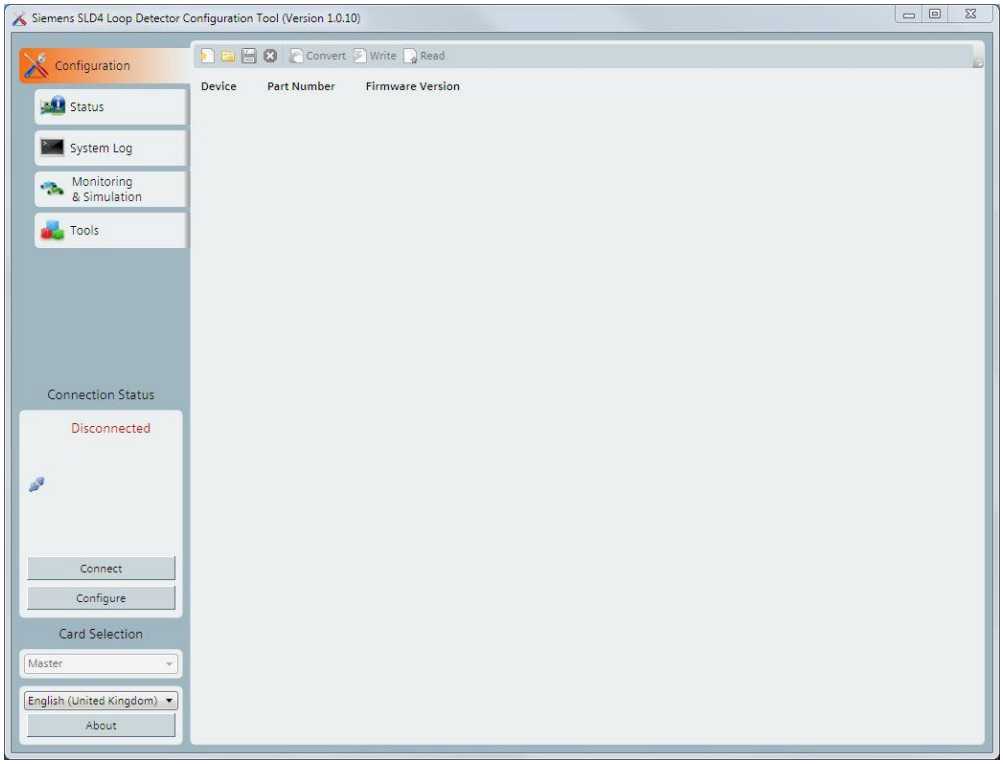
All data values that are entered are checked for validity and the appropriate symbol displayed:

Valid Data Flag

Invalid Data Flag

5.2.3 Main Window

The Main Window provides at all times, the available pages within the application, the connection status and options, card selection (when connected) and language selection:



Language selection will only be available if at least one alternative language dictionary is picked up from the Translations directory in the directory where SLD4 has been installed. (All language packs will be available for use when the application is installed)

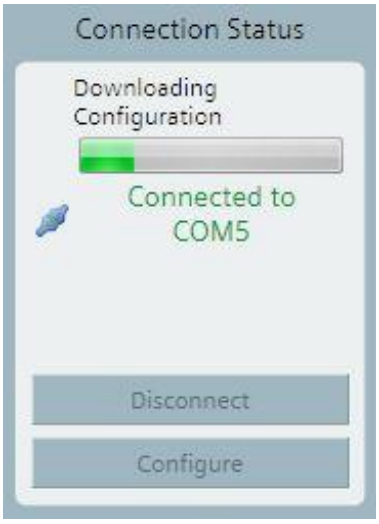
Card Selection will become available once a connection has been made to a master device. The drop down box is updated when used, therefore will always show all slaves connected to a master.

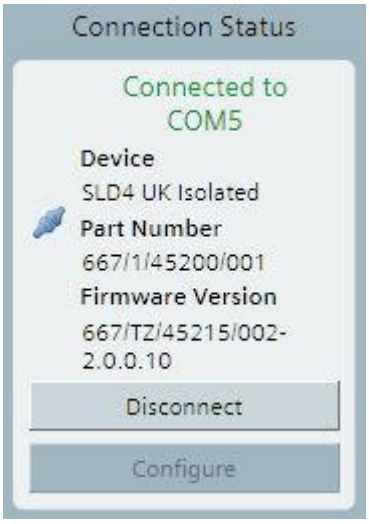
5.2.4 Connection Status

Connect/Disconnect

Use this to connect to an SLD4 device. A check will be made before the connection is established to ensure the device is an SLD4.

Upon a successful connection, the text will change to 'Disconnect' which can then be used to disconnect the application from the connected device. A local copy of the configuration definition for each card type is kept so if the card is of a new type, the configuration will be downloaded once as shown. The connected card description and firmware information will be displayed. This should be done if connecting to a different SLD4 device to ensure the correct device information is available.





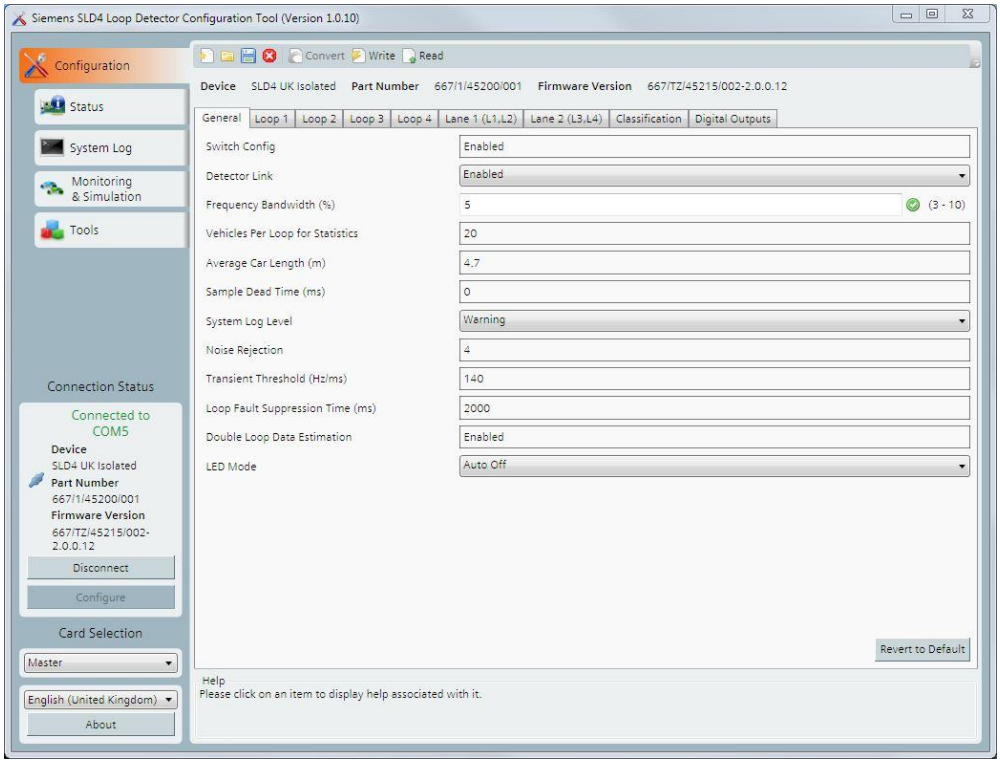
Configure Connection configuration allows selection of the COM port on which a device is connected.

5.2.5 Configuration

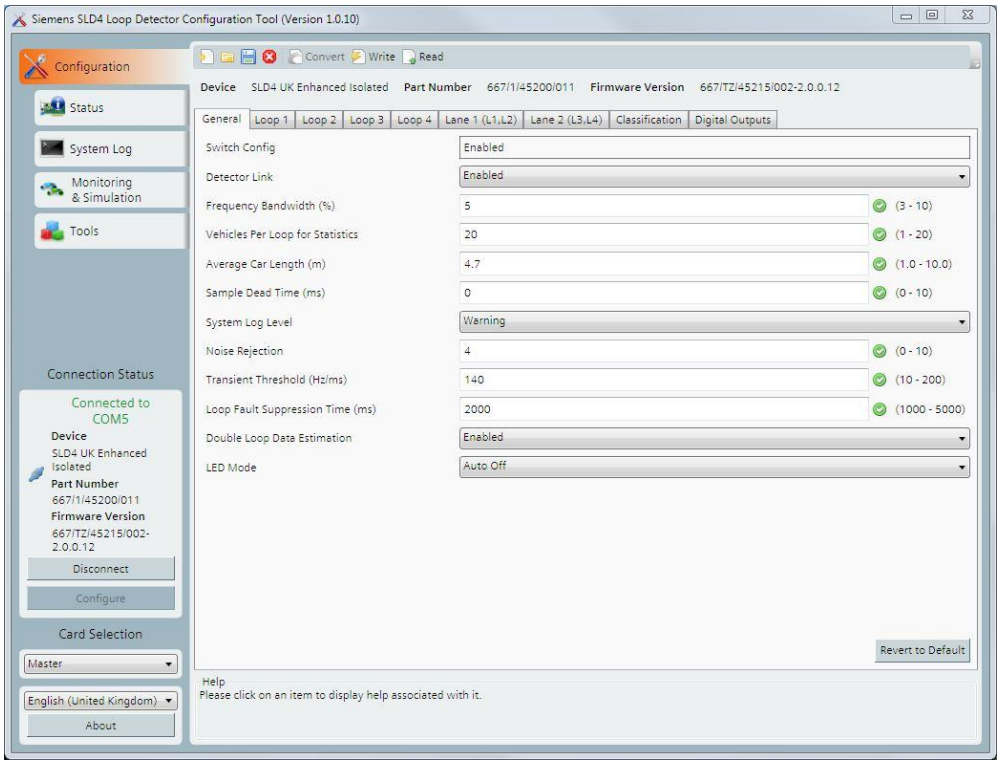
This page allows the creation of new configurations, writing of newly created configurations to SLD4 and reading and modification of configurations from connected SLD4s. Tabs group related configuration items.

For all configurable items the valid range is displayed to the right of the entry location with a valid/invalid flag. Clicking in the entry location will display help text for that entry in the help box at the bottom of the screen. For each tab, the default values can be loaded by pressing the Revert to Default button.

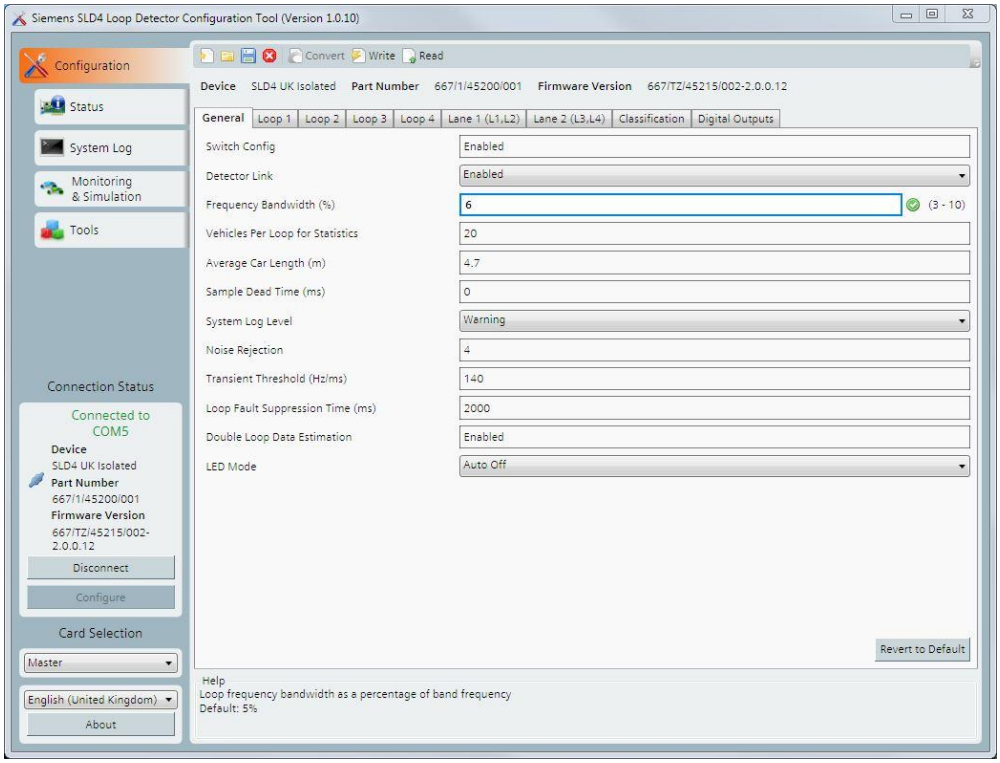
The example screen shot below shows a basic detector configuration after connection. Only parameters that can be altered for that variant are editable otherwise the default values are displayed.

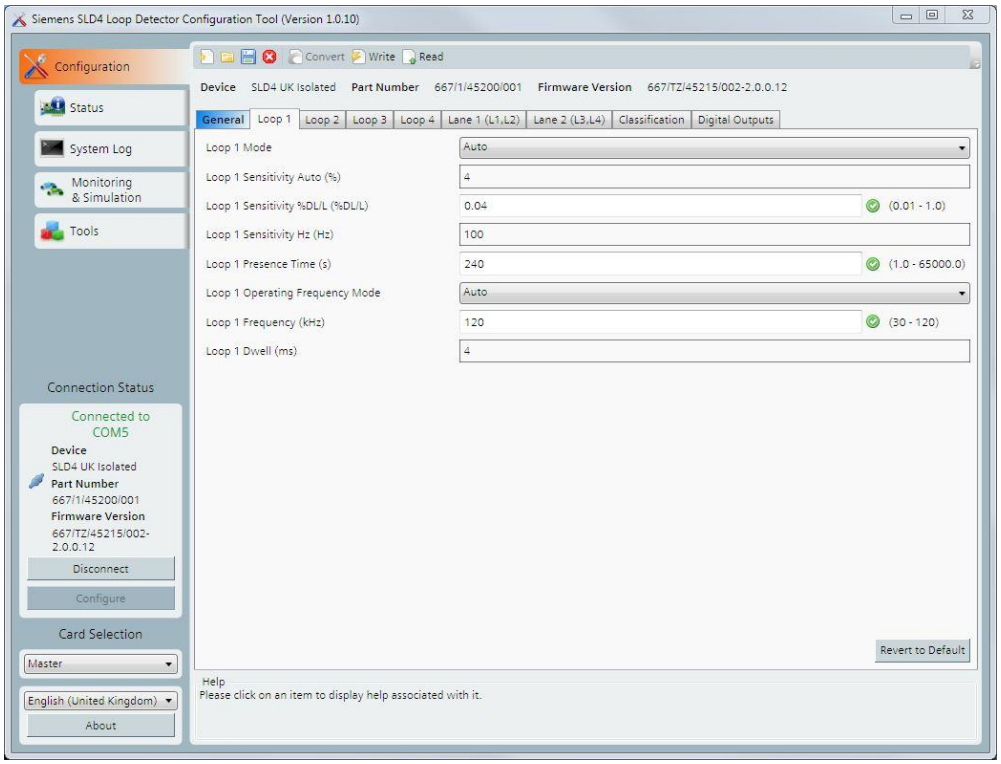


The example screen shot below shows the same configuration screen for the advanced version of the detector and it can be seen that all parameters are now available for edit.



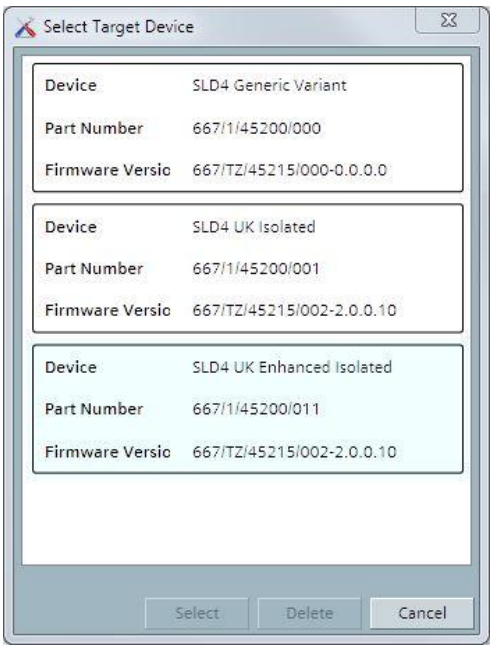
When a parameter is modified, the box border changes to blue to show that it has been modified but not saved to the detector. The tab colour also changes to a blue colour to indicate a value on that tab has been changed. Examples for the modified element and tab can be seen below:





Toolbar Options

New Creates a new blank configuration, all items will be set to their default values.



If more than one configuration type is available locally, the blank configuration can be set based on one of the locally stored configuration as shown on the left. Click on the desired configuration and then on [Select]. Unwanted configurations can be deleted using the [Delete] button.

Not until a configuration is loaded either from the local store or a detector are the configuration tabs shown.

Open Opens a previously saved configuration.

Save Saves the configuration.


Close Closes the configuration.


Writes the configuration to the currently selected device. Writing will not be possible if the configuration is invalid. Invalid items will be marked with a yellow exclamation mark 


Reads the configuration from the currently selected device. Note: A configuration does not need to be open.


Converts configurations between different variants of the detector.

5.2.6 General

This tab covers configuration items that apply to the whole detector and are not loop specific.

5.2.7 Loops

Configuration items specific to each loop are set here.

5.2.8 Lanes

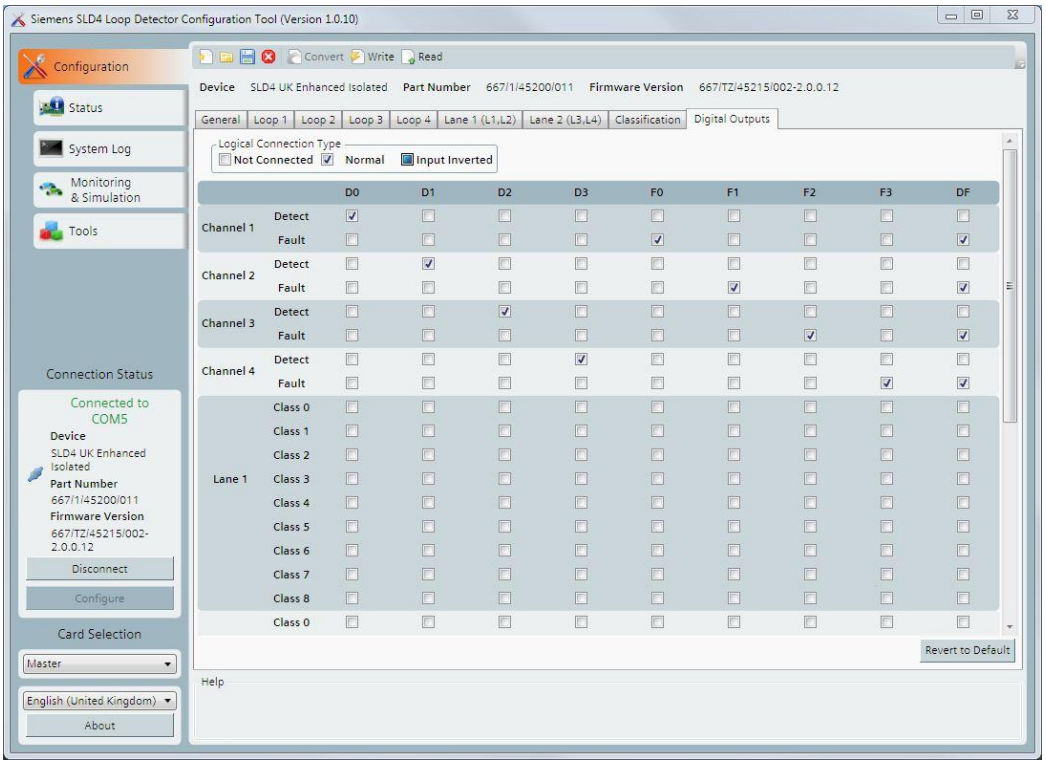
This tab covers the configuration of single & double loop operating modes allowing the user to set loop sizes and separation for each pair of channels. Lane 1 is associated with loop channels L1 & L2 and Lane 2 with loop channels L3 & L4.

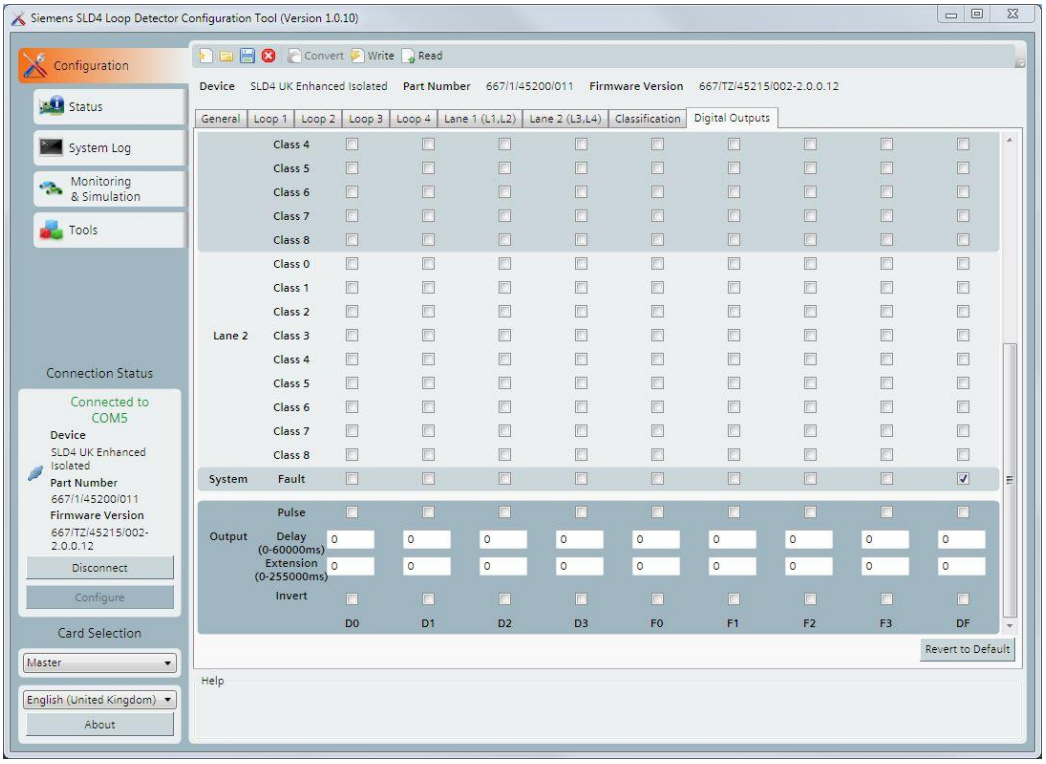
5.2.9 Classification

This tab covers configuration of the classifier classes. Nine classification classes can be set within the advanced detector.

5.2.10 Digital Outputs

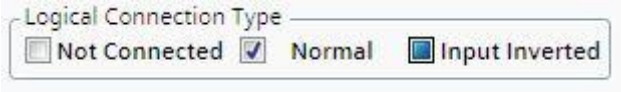
This tab provides a graphical interface for configuring the digital outputs and allows logical signals from the detector (such as detect, fault, classification type) to be mapped to physical outputs. The default state is shown on the screen shots below:





This configurable logical mapping process is made simple for the user by a matrix of tick boxes that allow one or more input state(s) (Horizontal) to be linked to one or more physical output(s) (Vertical)

The first click on a box links a state to an output. A second click links the state to the output but is inverted as shown in the key below.



The 'Pulse' Output tick box provides a 1ms active output pulse

Classification outputs provide a 100ms pulse by default which can be overridden by the 'Pulse', 'Delay' & 'Extension' modifiers.

The output activation using 'Pulse', 'Delay' & 'Extension' is shown in Figure 8 below. Values for 'Delay' and 'Extension' are entered in milliseconds.

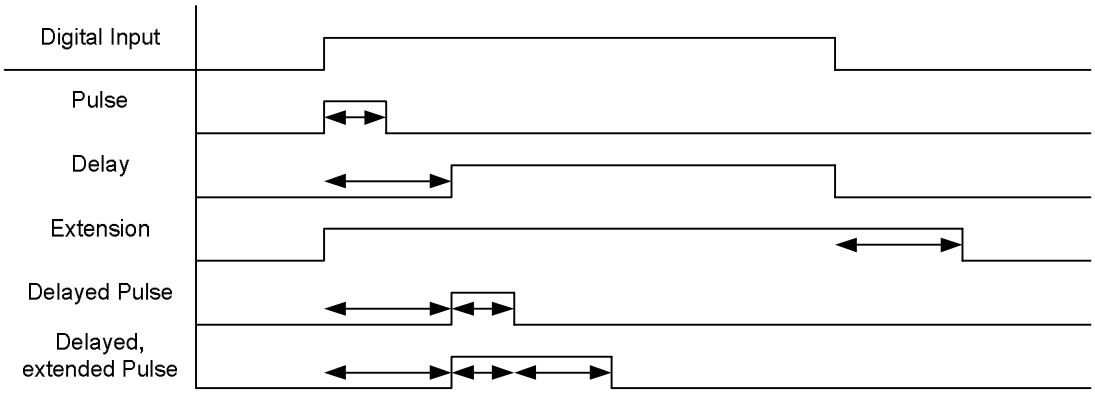


Figure 8 – Output Pulse, Delay & Extension

The physical outputs are listed across the bottom of the matrix, not all physical outputs are present of every variant of the detector.

Output Name	**Default Function**
D0 – D3	4 Detect outputs (SSR or Open Collector*)
F0 – F3	4 Fault outputs (Open Collector*)
DF	Common Detector Fault output (Open Collector*)

* - Variant dependant

Clicking on the 

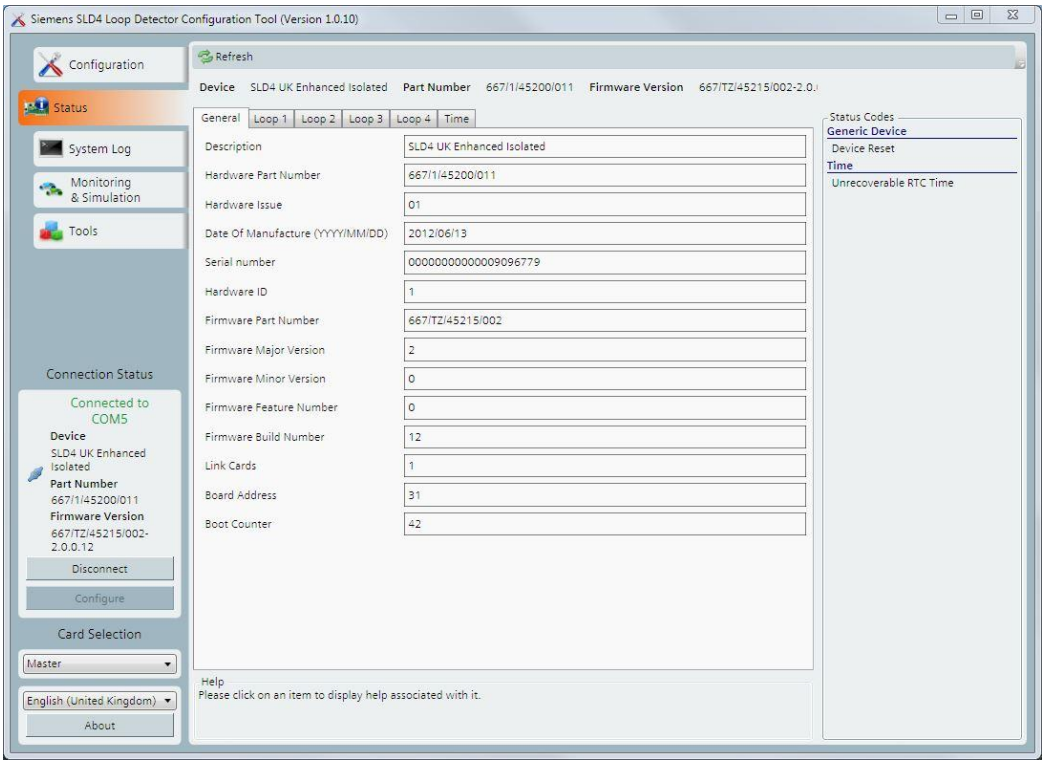
button on the configuration tab will populate the matrix with the detectors configuration.

Output changes made on the matrix are not written to the detector unless the 

button is clicked on the configuration tab.

5.2.11 Status

This page displays status information for the selected detector when connected and the [Refresh] button clicked. Help for each item displayed at the bottom of the page. Additionally, current status codes are displayed on the right-hand side of the screen. Individual tabs for loops and device time are available.



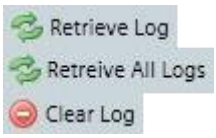
Note: For each loop the detector estimates the loop inductance based on the tuning of that loop. This estimation is only valid when the loop inductance range links are set to range 1 - 20 – 150µH (section 4.1.6)

5.2.12 System Log

This page is used for displaying log data from connected cards.

Items displayed in red identify those with an estimated time that can only be used as a reference. This is due to the item being logged before the last reboot, without knowledge of how long the device has been off.

Toolbar Options



Retrieves the log from the currently selected card only.

Retrieves logs from master and all connected slaves.

Clears the log on the currently selected card.

5.2.13 Monitoring & Simulation

This page has multiple uses as implied by the title; as a work area for creating vehicles to simulate and as a window to monitor vehicles currently passing over the loops of the connected device(s).

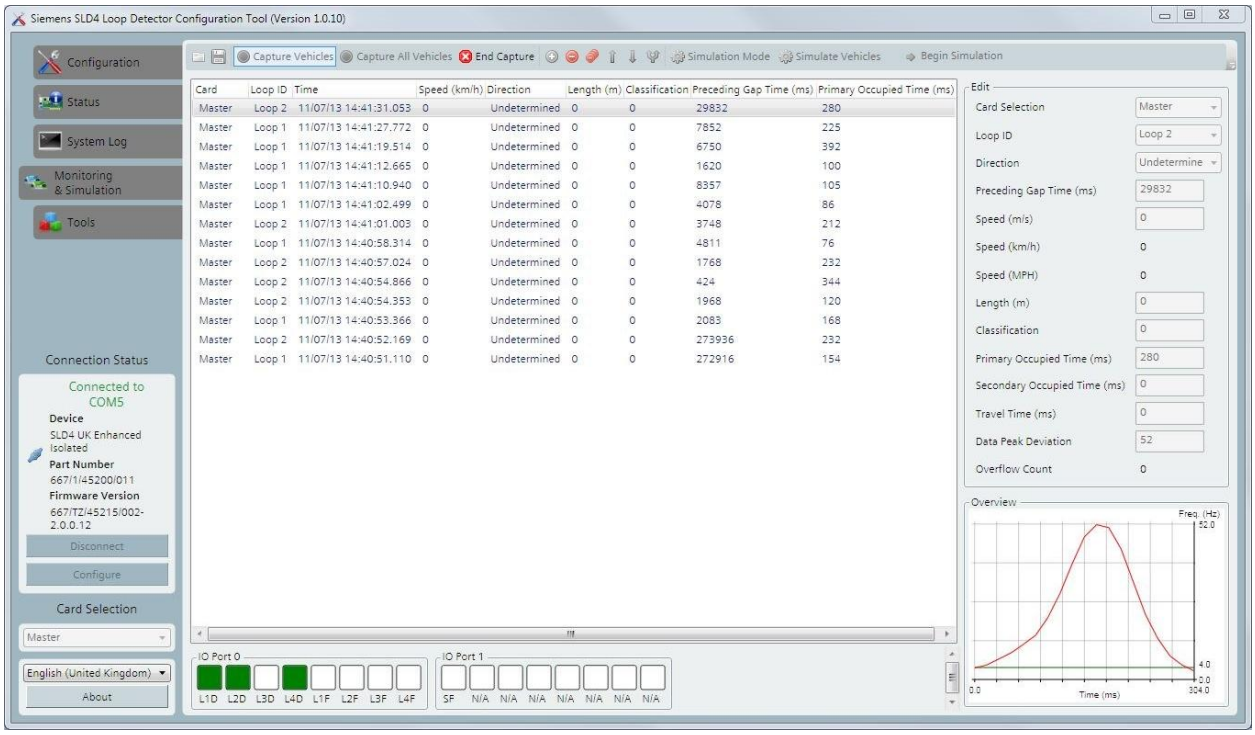
The [Edit] section on the right side shows the data of captured vehicles and allows editing of the data when simulating vehicles on one or more detectors. All numeric values are validated before being sent to the detector. Note: If an invalid entry is entered and then focus is moved to

another vehicle in the list, the invalid entry will be defaulted back to 0 or will remain as the last valid value.

The detector buffers the last 25 vehicle profiles and when capture is enabled the buffer contents will be downloaded to first empty the buffer prior to displaying vehicle data in 'real time'.

The Overview box contains a graphical representation of the frequency versus time data as the vehicle passed over the loop. The detect threshold is shown as a green line. This is useful for checking that vehicles are 'well over' the detect threshold and not marginal detections.

The IO Port indicators at the bottom of the page are displayed during capture and indicate when outputs are active.



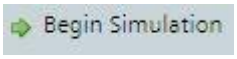
Toolbar Options

Load	Loads a previously saved list of vehicles.
Save	Saves the current list of vehicles.
Capture Vehicles	Captures vehicles from the currently selected card.
Capture All Vehicles	Captures vehicles from master and all connected slaves.
	Note: While capture is in progress no other tabs can be activated
End Capture	Stops an active capture session.
Add	Add a new blank vehicle to the list.
Delete	Delete the selected vehicle in the list.
Delete All	Delete all vehicles in the list.
Move Up	Move selected vehicle up in the list.
Move Down	Move selected vehicle down in the list.


Duplicate

Duplicate selected vehicle. The copied vehicle will appear under the selected vehicle.

Simulate (once) vehicles on the selected card. The card that the vehicles should be sent to can be selected in the Edit box under [Card Selection].



Begin cyclic simulation. Continues cyclic simulation until [end simulation] pressed.

Vehicle Simulation

The tool can simulate vehicles that have been previously captured, added manually or loaded (or a mix). There are a number of important points to remember when configuring a simulation:

- The total time for *all* simulated vehicles MUST be less than 30 seconds.
- There is a 25 vehicle limit for a simulation so no more than 25 vehicles can appear in the list
- The simulation order is automatically calculated from the [Preceding Gap Time] and [Primary Occupied Time].

5.2.14 Tools

This page provides additional features for a connected device consisting of upgrading SLD4 firmware, rebooting a device, restoring a device to factory defaults or reverting a device back to switch settings.

Note: Updating will only take place on the card which is connected via the serial USB cable. The [Card Selection] box has no effect with these functions.

Update Firmware

The detector allows new versions of firmware to be loaded into the device via the PC tool. The user must select a new firmware distribution file from the file system and upload it to the device after a confirmation message has been displayed. The tool is packaged with the latest firmware version that can be found on the local machine here:

Windows XP:

C:\Program Files\Siemens Traffic Solutions\Siemens SLD4 Configurator\Firmware

Windows 7:

C:\Program Files (x86)\Siemens Traffic Solutions\Siemens SLD4 Configurator\Firmware

1. Select the firmware file. (.fwr file)

2. Make sure a connection is already established from the application to the device. This allows a check of the firmware currently installed on the device.

3. Once [Start Update] is clicked, the firmware versions will be compared and details on proceedings will be displayed.

4. For the downloading of the new firmware, the application will be disconnected from the device so the update process can make its own connection. Progress information will be displayed during the download.

5. A message will finally be displayed stating the outcome of the update.

6. If the configuration is incompatible between firmware versions, this fault will be reported in the Status Code area and all four loop channels will remain in a fault state until the configuration is deleted (on the Tools page)

Reboot Device [Reboot]

This will reboot the device selected in the [Card Selection] box.

Restore Factory Defaults [Restore]

This will restore the selected device to the factory defaults. All configuration information will be lost including logs and loop configuration.

The [Restore] will invoke loop profiling as if the detector were powered up for the first time.

Revert To Switch Settings [Delete Configuration]

The configuration stored in the selected device will be erased and the device will revert to parameters set by the DIP switches.

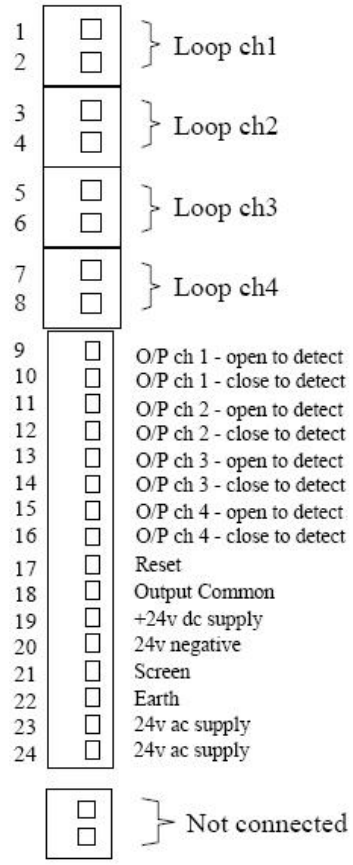
Both [Restore] and [Delete Configuration] will reinitialise the loop processing and detection state as if the detector were rebooted.

APPENDICIES

5.3 Appendix A – Backplane connections

Using Siemens Backplane 667/1/17205/000

Suitable for detector variants /001 and /011.



5.4 Appendix B – Connector Pinouts

Pinouts are colour coded to similar function types

	SLD4 UK1 Pinout – Variants 001 & 011 [TR2512A – SSR outputs]	
Pin	**Row a function**	**Row b function**
1	Channel 1 relay N/C output	NC
2	NC	Channel 1 relay Common output
3	Channel 1 relay N/O output	NC
4	Frequency selection bit 1 - LS bit [TR2512A]	NC
5	Channel 1 Loop A	Frequency selection bit 2 [TR2512A]
6	Frequency selection bit 3 [TR2512A]	Channel 1 Loop B
7	NC	Frequency selection bit 4 - MS bit [TR2512A]
8	NC	Channel 2 relay N/C output
9	Channel 2 relay Common output	NC
10	NC	Channel 2 relay N/O output
11	NC	Downstream Rx
12	Downstream Tx	Channel 2 Loop B
13	Channel 2 Loop A	Upstream Tx
14	Upstream Rx	Chassis Ground (GDT earth point)
15	Channel 3 relay N/C output	NC
16	NC	Channel 3 relay Common output
17	Channel 3 relay N/O output	NC
18	NC	24V AC 2 power supply input
19	Channel 3 Loop A	NC
20	NC	Channel 3 Loop B
21	24V AC 1 power supply input	NC
22	NC	Channel 4 relay N/C output
23	Channel 4 relay Common output	NC
24	NC	Channel 4 relay N/O output
25	NC	NC
26	NC	Channel 4 Loop B
27	Channel 4 Loop A	NC
28	NC	NC
29	-Reset input	NC
30	NC	+24V DC supply input
31	NC	NC
32	NC	0V DC supply input

	SLD4 UK2 Pinout – Variant 002 [Open Collector Detect + Fault outputs]	
Pin	**Row a function**	**Row b function**
1	Channel 1 O.C. detect output	Channel 1 O.C. fault output
2	NC	NC
3	NC	NC
4	Frequency selection bit 1 - LS bit [TR2512A]	Master Fault O.C. output
5	Channel 1 Loop A	Frequency selection bit 2 [TR2512A]
6	Frequency selection bit 3 [TR2512A]	Channel 1 Loop B
7	NC	Frequency selection bit 4 - MS bit [TR2512A]
8	Channel 2 O.C. fault output	Channel 2 O.C. detect output
9	NC	NC
10	NC	NC
11	Common return for all O.C. outputs**	Downstream Rx
12	Downstream Tx	Channel 2 Loop B
13	Channel 2 Loop A	Upstream Tx
14	Upstream Rx	Chassis Ground (GDT earth point)
15	Channel 3 O.C. detect output	Channel 3 O.C. fault output
16	NC	NC
17	NC	NC
18	NC	24V AC 2 power supply input
19	Channel 3 Loop A	NC
20	NC	Channel 3 Loop B
21	24V AC 1 power supply input	NC
22	Channel 4 O.C. fault output	Channel 4 O.C. detect output
23	NC	NC
24	NC	NC
25	NC	NC
26	NC	Channel 4 Loop B
27	Channel 4 Loop A	NC
28	NC	NC
29	-Reset input	NC
30	NC	+24V DC supply input
31	NC	NC
32	NC	0V DC supply input
	Only use variant B when powered from 24V DC	** - Factory Option to link to 0V DC supply

(If AC power used [not recommended] – this supply **MUST** be floating)

	SLD4 UK3 Pinout– Variant 003 [Serial Only – integrated UK for IDB]	
Pin	**Row a function**	**Row b function**
1	NC	NC
2	NC	NC
3	NC	NC
4	Frequency selection bit 1 - LS bit [TR2512A]	NC
5	Channel 1 Loop A	Frequency selection bit 2 [TR2512A]
6	Frequency selection bit 3 [TR2512A]	Channel 1 Loop B
7	NC	Frequency selection bit 4 - MS bit [TR2512A]
8	NC	NC
9	NC	NC
10	NC	NC
11	NC	Downstream Rx
12	Downstream Tx	Channel 2 Loop B
13	Channel 2 Loop A	Upstream Tx
14	Upstream Rx	Chassis Ground (GDT earth point)
15	NC	NC
16	NC	NC
17	NC	NC
18	NC	NC
19	Channel 3 Loop A	NC
20	NC	Channel 3 Loop B
21	NC	Detector Address bit 1 - LS bit
22	NC	NC
23	NC	NC
24	NC	NC
25	RS422 TxD+ (Y) - GSPI	RS422 TxD- (Z) - GSPI
26	NC	Channel 4 Loop B
27	Channel 4 Loop A	RS422 Gnd – this is board logic GND **
28	RS422 RxD- (B) - GSPI	RS422 RxD+ (A) - GSPI
29	-Reset input	Detector Address bit 2
30	Detector Address bit 3	+24V DC supply input
31	NC	Detector Address bit 4
32	Detector Address bit 5	0V DC supply input
	Must be used with negative ground 24V DC PSU	** - Factory Option to link to 0V DC supply

	SLD4 Non UK Pinout – Variants 504-507	
Pin	**Row a function**	**Row b function**
1	NC	Channel 1 O.C. fault output - FEHL1
2	Channel 1 O.C. detect output	NC
3	NC	[This pin grounded on DE backplane]
4	Frequency selection bit 1 - LS bit [TR2512A]	Master Fault O.C. output
5	Channel 1 Loop A	Frequency selection bit 2 [TR2512A]
6	Frequency selection bit 3 [TR2512A]	Channel 1 Loop B
7	NC	Frequency selection bit 4 - MS bit [TR2512A]
8	Channel 2 O.C. fault output - FEHL2	NC
9	NC	Channel 2 O.C. detect output
10	[This pin grounded on DE backplane]	NC
11	Common return for all O.C. outputs **	NC
12	Downstream Tx	Channel 2 Loop B
13	Channel 2 Loop A	Upstream Tx
14	Upstream Rx	Chassis Ground (GDT earth point)
15	NC	Channel 3 O.C. fault output - FEHL3
16	Channel 3 O.C. detect output	NC
17	NC	[This pin grounded on DE backplane]
18	RS422 RxD+ (A) - GSPI	Downstream Rx
19	Channel 3 Loop A	RS422 TxD- (Z) - GSPI
20	RS422 TxD+ (Y) - GSPI	Channel 3 Loop B
21	NC	Detector Address bit 1 - LS bit
22	Channel 4 O.C. fault output - FEHL4	NC
23	NC	Channel 4 O.C. detect output
24	[This pin grounded on DE backplane]	NC
25	Sout - TTL	RS485 A - SiTOS
26	-Sen [direction control]	Channel 4 Loop B
27	Channel 4 Loop A	RS485/RS422 Gnd - this is board logic GND **
28	RS485 B - SiTOS	Sin - TTL
29	-Reset input	Detector Address bit 2
30	Detector Address bit 3	+24V DC supply input
31	RS422 RxD- (B) - GSPI	Detector Address bit 4
32	Detector Address bit 5	0V DC supply input
		** - Factory Option to link to 0V DC supply

5.5 Appendix C – Switch and Link positions

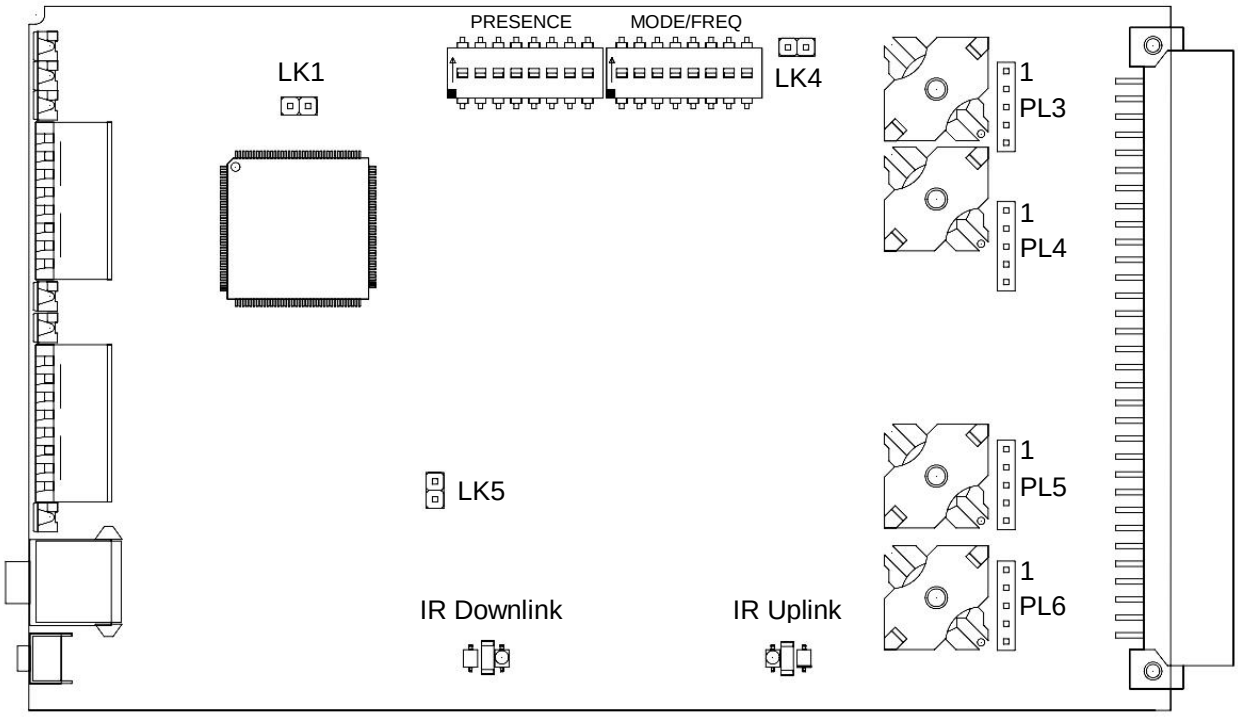


Figure 9 – Switch and Link Positions

Link functions where applicable

LK1 - Software Update Link – not normally fitted

LK4 - Inter-card link speed – not normally fitted

LK5 - RS422/RS485 select. Link installed for RS422 operation, Uninstalled for RS485

Installed by default on UK variant /003

Installed by default on German variants:

667/1/45200/506 (S24763-A82-A5) and 667/1/45200/507 (S24763-A82-A6)

PL3 – Loop 1 inductance setup links. See section 4.1.6

PL4 – Loop 2 inductance setup links.

PL5 – Loop 3 inductance setup links.

PL6 – Loop 4 inductance setup links.

The IR link components are shown (IR Uplink & IR Downlink) as these areas of the board should be periodically inspected for contamination. Any foreign objects or high levels of dust/dirt will affect the IR link performance (or stop it working). Clean with a small brush or air duster during routine inspection/maintenance.

5.6 Appendix D – Effect of long feeders

5.6.1 Summary

Feeder lengths more than 300m may be used provided that detection of bicycles and motorcycles is not required.

In particular when installing loops on heavily reinforced concrete the sensitivity will be reduced if the spacing of loop conductors from the reinforcing bars is less than specified. Also where a tarmac surface includes furnace slag or similar materials the sensitivity will be impaired. Both of these effects will be made worse by long feeders.
The following information is provided for users who need to use the detector outside of the normal working parameters. (ie above 300M cable length, in highly reinforced road surfaces, loops with unusual numbers of turns)

5.6.2 Effect of feeder length

The SLD4 has been tested with feeder lengths up to 1000 meters. Increasing feeder length will make the apparent sensitivity decrease. This is because the detector functions by measuring the percentage change of inductance as seen at its terminals. The loop inductance is altered when metal objects (vehicles) enter the loop. However adding feeder cable increases the apparent inductance at the detector terminals – and this additional inductance is not affected by the vehicle. As only part of the inductance is changing, the effect is to reduce the apparent sensitivity of the detector. The method by which the detector calculates the inductance means that the effect of longer feeders is minimized as the SLD4 characterizes the connected loops.

For applications where detection of bicycles and motorcycles is not required (e.g. SCOOT) feeder lengths greater than 300m may be used. In order to overcome the loss of apparent sensitivity, the detector may be set to a more sensitive setting than normal.

Putting loops in reinforced concrete surfaces is standard practice and the sensitivity of the detector is adequate for this. However the effect of long feeders on sensitivity adds to the effect of steel reinforcing mesh and the user must be aware of the risk of combining risk factors.

The graph shown in Figure 10 shows a guide to the loss in sensitivity due to feeder.

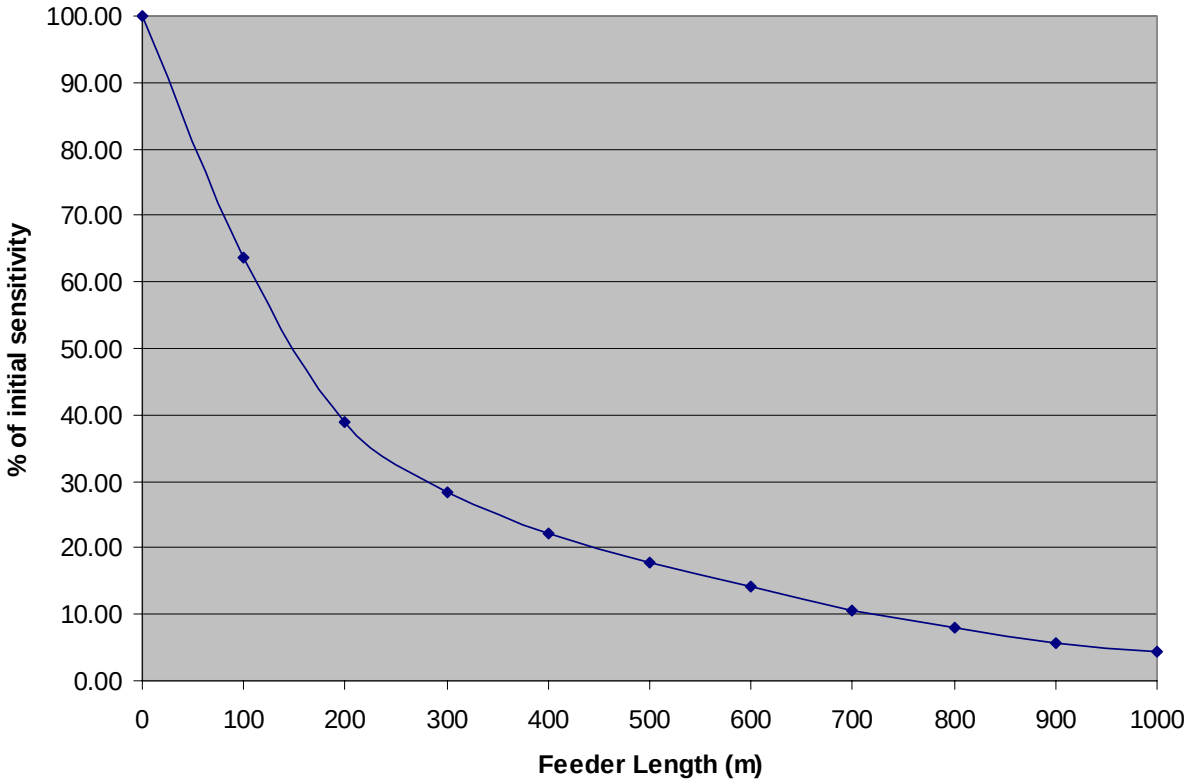


Figure 10 – Loss of Sensitivity due to Feeder

This graph shown above should be used as a guide only as there are many factors that affect the actual sensitivity.

5.6.3 Maximum inductance

Long feeders increase the apparent inductance as seen at the detector terminals. (Note that measurement of inductance with an LCR meter is invalid for this purpose as these operate at a low fixed frequency - usually 1KHz - and the detector is not a true inductance measuring device). Large values of inductance restrict the use of higher frequency settings via switches F1-F4 or the frequencies allocated when in automatic mode. The limits of allowable inductance are shown in section 4.1.6

5.7 Appendix E – Specification

Power Supply	Either: 24VAC +20%, -25%, 50/60Hz Or: 10-32VDC
Power Consumption @24VDC /001 /011 variant /002 variant	 1.0W with LEDs off, 1.5W with LEDs on 0.75W with LEDs off, 1.0W with LEDs on
Power break support times	50ms @24VAC, 20ms @24VAC -25%
Size	160mm x 100mm x 25mm
Operating Temperature Range	-25°C +80°C
Loop Inductance Tuning Range	0-300m, See Appendix C for longer feeder lengths
Loop Operating Frequency	30KHz – 120KHz
Vehicle Speed Range	0 to 250 km/h using loops as specified in 667/HE/20663/000
Isolated Relay Outputs (/001 & /011 variants only)	One isolated changeover 'detect' output per loop. Withstand: 75VDC Capacity: 50mA continuous with 2.5V max drop 300mA/10ms pulse
Non-Isolated Open Collector Outputs (/002 & /504 to /507 variants only)	One non-isolated open collector 'detect' output per loop. Withstand: 35VDC Capacity: 50mA continuous with 2.5V max drop 100mA/10ms pulse
Approvals	TR2512A Compliant (/001 and /011 variants) ETSI 300-330 Radio Approval CE Approved RoHS Compliant

Warning: See warning in section 2.1.2

It is highly recommended that only the isolated relay output connections on variants /001 & /011 are used when powered from an AC supply.

Recommended power supply operation

Variant	Power Supply	Reason
001 011	AC or DC	Isolated detect relay outputs allow the use of AC supplies
002	AC or DC	Open collector transistor outputs are referenced to logic ground If AC supply is used this **MUST** be floating
003	DC only	Serial interfaces are referenced to logic ground
504-507	DC only	Open collector transistor outputs & Serial interfaces are referenced to logic ground

5.8 Appendix F – Installing USB Drivers

This section describes how to install the USB drivers for the dedicated USB interface cable.

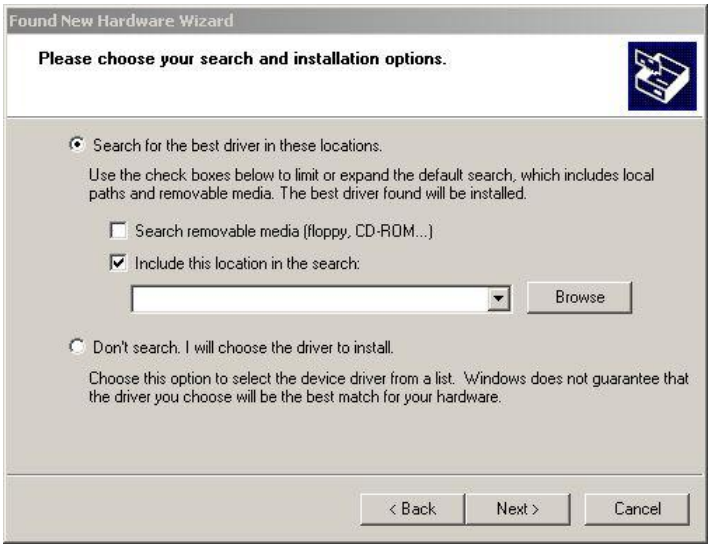
The example given for Windows XP 32 bit Operating System

1. Acquire driver pack from <www.ftdichip.com> (or supplied in installation directory of PC tool):
    a. Select 'Drivers' from the left hand menu
    b. Select the 'VCP' driver link
    c. Select drivers for the appropriate operating system – in this example 'Windows x86 (32-bit) WHQL certified drivers and save the zip file.
    d. Unzip the driver pack to a known location on the machine.

2. Plug the USB cable into a USB socket –Windows will detect the new device:

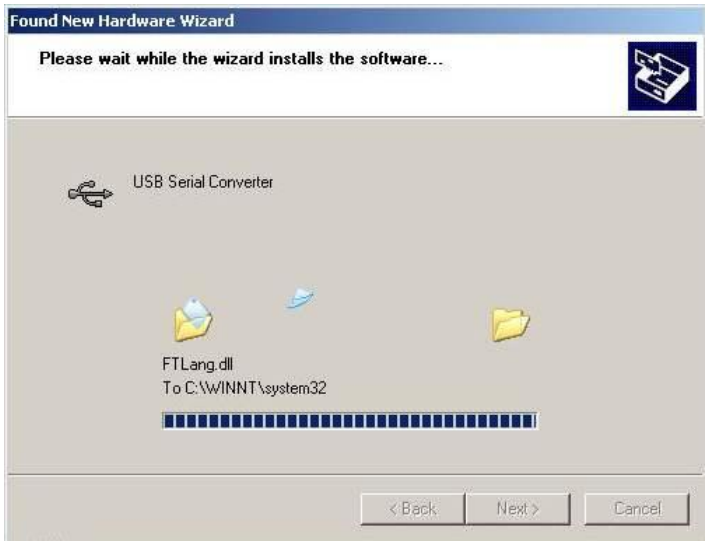
3. Select 'Install from a list or specific location (Advanced)'

4. Select 'Include this location in the search'



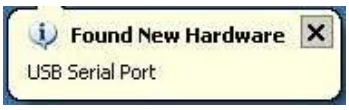
5. Browse to the folder where the drivers where unzipped to and press ‘OK’

6. Select ‘Next’, the USB Serial converter will be installed:

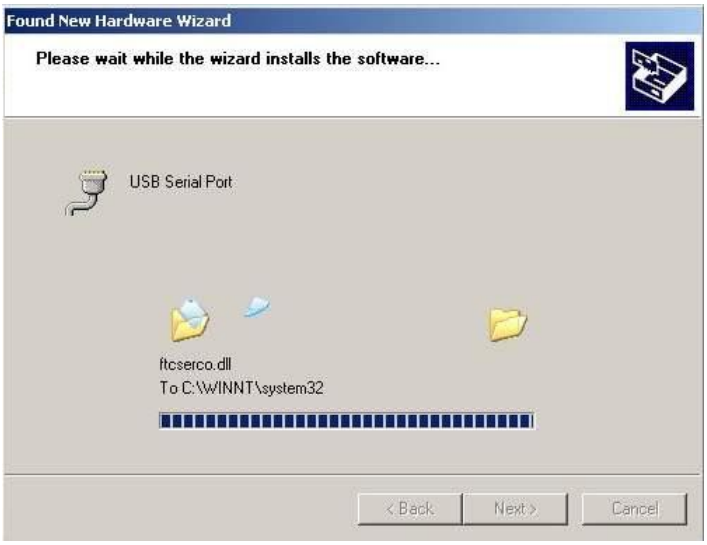


If Windows XP is configured to warn when unsigned (non-WHQL certified) drivers are about to be installed, the message dialogue shown below will be displayed unless installing a Microsoft WHQL certified driver. Select ‘Continue Anyway’ to continue with the installation. If Windows XP is configured to ignore file signature warnings, no message will appear.

7. Select ‘Finish’, Windows will now detect a USB Serial Port:



8. Follow steps 3 to 7 again to install the USB Serial Port Drivers:



If Windows XP is configured to warn when unsigned (non-WHQL certified) drivers are about to be installed, the message dialogue shown below will be displayed unless installing a Microsoft WHQL certified driver. Select ‘Continue Anyway’ to continue with the installation. If Windows XP is configured to ignore file signature warnings, no message will appear.

9. After installation, Windows will display the completed message:

10. The driver installation is now complete.

    Note: Plugging the cable into a different USB port on a PC will invoke the driver installation again.

5.9 Appendix G – Frequently Asked Questions

This section lists some of the frequently asked questions that might help to resolve some installation and configuration problems:

- Not detecting vehicles: The SLD4 can work with loop inductances down to 20uH. If a short circuit fault is present on the end of a medium to long feeder cable the detector will not be able to detect this as the cable will present an inductive load that is above the minimum 20uH.
- Connection with a PC: If the SLD4 is powered from an AC source, any device connected to the front panel handset port **MUST** be floating. Always unplug the PC from any other equipment and the charger. Failure to do this will result in damage to the detector and possibly the PC.
- Mode LED doesn't indicate software configuration active: The software configuration active state can be identified as the Mode LED will double flash AFTER auto setup is complete. As auto setup requires 20 vehicles to pass over each loop, setup can take some time in certain circumstances.
- Configuration Checksum Failed reported in Status Codes after firmware upgrade
  If the configuration is incompatible between firmware versions this fault will be reported and the card will indicate faults on all loops. To remedy this, the user must delete the original configuration and re-configure the card.
- Certain configuration parameters updated using tool are not changed when read back
  Parameters that can be affected by switch settings are changed in the tool and written to the detector but are then read back unchanged because the switch Config (On configuration – General tab) is set to *enabled* so the switch settings take preference over the tool settings. Select Switch Config – *Disabled* to allow these parameters to be modified in the tool.

6 MAINTENANCE

Before starting any maintenance work, read the Safety Warning on page 2 of this Handbook.

6.1 Routine Maintenance Visits

The interval between visits depends on local conditions but may consist of the following:

- Check the detector securing screws are tight.
- Check that no debris (spiders webs etc) are in the vicinity of the inter-board IR links (Bottom edge of the board – see section 5.5)

6.2 First Line Maintenance

First line maintenance will be achieved on a modular replacement basis.

1. Check which type of detector is fitted.
2. Note the detector configuration (This can be switches and/or firmware configuration depending on the type of detector)
3. Fit a replacement detector of the same type.
4. Configure the replacement detector in the same way as the detector that was removed.

6.3 Second Line Maintenance

The faulty parts being returned must always be sent back in the original packaging if available or in an approved Anti Static packaging, along with a fully completed Fault Label to the following address:

Logistics Spares Returns Centre
Siemens Mobility
Traffic Solutions
Coalfield Way
Ashby Park
Ashby de la Zouch
LE65 1JD

Fort UK users, any queries should be directed to the Service Logistics Manager on (01530) 258181

***NOTE:* Observe Anti Static Precautions at all times**